2017

FRM® Part II Practice Exam

GARP | FRM

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Introduction

The FRM Exam is a practice-oriented examination. Its questions are derived from a combination of theory, as set forth in the core readings, and "real-world" work experience. Candidates are expected to understand risk management concepts and approaches and how they would apply to a risk manager's day-to-day activities.

The FRM Exam is also a comprehensive examination, testing a risk professional on a number of risk management concepts and approaches. It is very rare that a risk manager will be faced with an issue that can immediately be slotted into one category. In the real world, a risk manager must be able to identify any number of risk-related issues and be able to deal with them effectively.

The 2017 FRM Part I and Part II Practice Exams have been developed to aid candidates in their preparation for the FRM Exam in May and November 2017. These Practice Exams are based on a sample of questions from prior FRM Exams and are suggestive of the questions that will be in the 2017 FRM Exam.

The 2017 FRM Part I Practice Exam contains 100 multiple-choice questions and the 2017 FRM Part II Practice Exam contains 80 multiple-choice questions, the same number of questions that the actual 2017 FRM Exam Part I and 2017 FRM Exam Part II will contain. As such, the Practice Exams were designed to allow candidates to calibrate their preparedness both in terms of material and time.

The 2017 FRM Practice Exams do not necessarily cover all topics to be tested on the 2017 FRM Exam as any test will sample from the universe of testable possible knowledge points. However, the questions selected for inclusion in the Practice Exams were chosen to be broadly reflective of the material assigned for 2017 as well as to represent the style of question that the FRM Committee considers appropriate based on assigned material.

For a complete list of current topics, core readings, and key learning objectives candidates should refer to the 2017 FRM Exam Study Guide and 2017 FRM Learning Objectives.

Core readings were selected by the FRM Committee to assist candidates in their review of the subjects covered by the Exam. Questions for the FRM Exam are derived from the core readings. It is strongly suggested that candidates study these readings in depth prior to sitting for the Exam.

Suggested Use of Practice Exams
To maximize the effectiveness of the practice exams, candidates are encouraged to follow these recommendations:

1. **Plan a date and time to take the practice exam.**
   Set dates appropriately to give sufficient study/review time for the practice exam prior to the actual exam.

2. **Simulate the test environment as closely as possible.**
   - Take the practice exam in a quiet place.
   - Have only the practice exam, candidate answer sheet, calculator, and writing instruments (pencils, erasers) available.
   - Minimize possible distractions from other people, cell phones, televisions, etc.; put away any study material before beginning the practice exam.
   - Allocate 4 hours to complete FRM Part I Practice Exam and 4 hours to complete FRM Part II Practice Exam and keep track of your time. The actual FRM Exam Part I and FRM Exam Part II are 4 hours each.

- Complete the entire exam and answer all questions. Points are awarded for correct answers. There is no penalty on the FRM Exam for an incorrect answer.
- Follow the FRM calculator policy. Candidates are only allowed to bring certain types of calculators into the exam room. The only calculators authorized for use on the FRM Exam in 2017 are listed below, there will be no exceptions to this policy. You will not be allowed into the exam room with a personal calculator other than the following: Texas Instruments BA II Plus (including the BA II Plus Professional), Hewlett Packard 12C (including the HP 12C Platinum and the Anniversary Edition), Hewlett Packard 10B II, Hewlett Packard 10B II+ and Hewlett Packard 20B.

3. After completing the FRM Practice Exams

- Calculate your score by comparing your answer sheet with the practice exam answer key.
- Use the practice exam Answers and Explanations to better understand the correct and incorrect answers and to identify topics that require additional review. Consult referenced core readings to prepare for the exam.
- Remember: pass/fail status for the actual exam is based on the distribution of scores from all candidates, so use your scores only to gauge your own progress and level of preparedness.

Reference Table: Let Z be a standard normal random variable.

z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)
-3	0.0013	-2.50	0.0062	-2.00	0.0228	-1.50	0.0668	-1.00	0.1587	-0.50	0.3085
-2.99	0.0014	-2.49	0.0064	-1.99	0.0233	-1.49	0.0681	-0.99	0.1611	-0.49	0.3121
-2.98	0.0014	-2.48	0.0066	-1.98	0.0239	-1.48	0.0694	-0.98	0.1635	-0.48	0.3156
-2.97	0.0015	-2.47	0.0068	-1.97	0.0244	-1.47	0.0708	-0.97	0.1660	-0.47	0.3192
-2.96	0.0015	-2.46	0.0069	-1.96	0.0250	-1.46	0.0721	-0.96	0.1685	-0.46	0.3228
-2.95	0.0016	-2.45	0.0071	-1.95	0.0256	-1.45	0.0735	-0.95	0.1711	-0.45	0.3264
-2.94	0.0016	-2.44	0.0073	-1.94	0.0262	-1.44	0.0749	-0.94	0.1736	-0.44	0.3300
-2.93	0.0017	-2.43	0.0075	-1.93	0.0268	-1.43	0.0764	-0.93	0.1762	-0.43	0.3336
-2.92	0.0018	-2.42	0.0078	-1.92	0.0274	-1.42	0.0778	-0.92	0.1788	-0.42	0.3372
-2.91	0.0018	-2.41	0.0080	-1.91	0.0281	-1.41	0.0793	-0.91	0.1814	-0.41	0.3409
-2.9	0.0019	-2.40	0.0082	-1.90	0.0287	-1.40	0.0808	-0.90	0.1841	-0.40	0.3446
-2.89	0.0019	-2.39	0.0084	-1.89	0.0294	-1.39	0.0823	-0.89	0.1867	-0.39	0.3483
-2.88	0.0020	-2.38	0.0087	-1.88	0.0301	-1.38	0.0838	-0.88	0.1894	-0.38	0.3520
-2.87	0.0021	-2.37	0.0089	-1.87	0.0307	-1.37	0.0853	-0.87	0.1922	-0.37	0.3557
-2.86	0.0021	-2.36	0.0091	-1.86	0.0314	-1.36	0.0869	-0.86	0.1949	-0.36	0.3594
-2.85	0.0022	-2.35	0.0094	-1.85	0.0322	-1.35	0.0885	-0.85	0.1977	-0.35	0.3632
-2.84	0.0023	-2.34	0.0096	-1.84	0.0329	-1.34	0.0901	-0.84	0.2005	-0.34	0.3669
-2.83	0.0023	-2.33	0.0099	-1.83	0.0336	-1.33	0.0918	-0.83	0.2033	-0.33	0.3707
-2.82	0.0024	-2.32	0.0102	-1.82	0.0344	-1.32	0.0934	-0.82	0.2061	-0.32	0.3745
-2.81	0.0025	-2.31	0.0104	-1.81	0.0351	-1.31	0.0951	-0.81	0.2090	-0.31	0.3783
-2.8	0.0026	-2.30	0.0107	-1.80	0.0359	-1.30	0.0968	-0.80	0.2119	-0.30	0.3821
-2.79	0.0026	-2.29	0.0110	-1.79	0.0367	-1.29	0.0985	-0.79	0.2148	-0.29	0.3859
-2.78	0.0027	-2.28	0.0113	-1.78	0.0375	-1.28	0.1003	-0.78	0.2177	-0.28	0.3897
-2.77	0.0028	-2.27	0.0116	-1.77	0.0384	-1.27	0.1020	-0.77	0.2206	-0.27	0.3936
-2.76	0.0029	-2.26	0.0119	-1.76	0.0392	-1.26	0.1038	-0.76	0.2236	-0.26	0.3974
-2.75	0.0030	-2.25	0.0122	-1.75	0.0401	-1.25	0.1056	-0.75	0.2266	-0.25	0.4013
-2.74	0.0031	-2.24	0.0125	-1.74	0.0409	-1.24	0.1075	-0.74	0.2296	-0.24	0.4052
-2.73	0.0032	-2.23	0.0129	-1.73	0.0418	-1.23	0.1093	-0.73	0.2327	-0.23	0.4090
-2.72	0.0033	-2.22	0.0132	-1.72	0.0427	-1.22	0.1112	-0.72	0.2358	-0.22	0.4129
-2.71	0.0034	-2.21	0.0136	-1.71	0.0436	-1.21	0.1131	-0.71	0.2389	-0.21	0.4168
-2.7	0.0035	-2.20	0.0139	-1.70	0.0446	-1.20	0.1151	-0.70	0.2420	-0.20	0.4207
-2.69	0.0036	-2.19	0.0143	-1.69	0.0455	-1.19	0.1170	-0.69	0.2451	-0.19	0.4247
-2.68	0.0037	-2.18	0.0146	-1.68	0.0465	-1.18	0.1190	-0.68	0.2483	-0.18	0.4286
-2.67	0.0038	-2.17	0.0150	-1.67	0.0475	-1.17	0.1210	-0.67	0.2514	-0.17	0.4325
-2.66	0.0039	-2.16	0.0154	-1.66	0.0485	-1.16	0.1230	-0.66	0.2546	-0.16	0.4364
-2.65	0.0040	-2.15	0.0158	-1.65	0.0495	-1.15	0.1251	-0.65	0.2578	-0.15	0.4404
-2.64	0.0041	-2.14	0.0162	-1.64	0.0505	-1.14	0.1271	-0.64	0.2611	-0.14	0.4443
-2.63	0.0043	-2.13	0.0166	-1.63	0.0516	-1.13	0.1292	-0.63	0.2643	-0.13	0.4483
-2.62	0.0044	-2.12	0.0170	-1.62	0.0526	-1.12	0.1314	-0.62	0.2676	-0.12	0.4522
-2.61	0.0045	-2.11	0.0174	-1.61	0.0537	-1.11	0.1335	-0.61	0.2709	-0.11	0.4562
-2.6	0.0047	-2.10	0.0179	-1.60	0.0548	-1.10	0.1357	-0.60	0.2743	-0.10	0.4602
-2.59	0.0048	-2.09	0.0183	-1.59	0.0559	-1.09	0.1379	-0.59	0.2776	-0.09	0.4641
-2.58	0.0049	-2.08	0.0188	-1.58	0.0571	-1.08	0.1401	-0.58	0.2810	-0.08	0.4681
-2.57	0.0051	-2.07	0.0192	-1.57	0.0582	-1.07	0.1423	-0.57	0.2843	-0.07	0.4721
-2.56	0.0052	-2.06	0.0197	-1.56	0.0594	-1.06	0.1446	-0.56	0.2877	-0.06	0.4761
-2.55	0.0054	-2.05	0.0202	-1.55	0.0606	-1.05	0.1469	-0.55	0.2912	-0.05	0.4801
-2.54	0.0055	-2.04	0.0207	-1.54	0.0618	-1.04	0.1492	-0.54	0.2946	-0.04	0.4840
-2.53	0.0057	-2.03	0.0212	-1.53	0.0630	-1.03	0.1515	-0.53	0.2981	-0.03	0.4880
-2.52	0.0059	-2.02	0.0217	-1.52	0.0643	-1.02	0.1539	-0.52	0.3015	-0.02	0.4920
-2.51	0.0060	-2.01	0.0222	-1.51	0.0655	-1.01	0.1562	-0.51	0.3050	-0.01	0.4960

Special Instructions and Definitions

1. Unless otherwise indicated, interest rates are assumed to be continuously compounded.
2. Unless otherwise indicated, option contracts are assumed to be on one unit of the underlying asset.
3. VaR = value-at-risk
4. ES = expected shortfall
5. GARCH = generalized auto-regressive conditional heteroskedasticity
6. EWMA = exponentially weighted moving average
7. CAPM = capital asset pricing model
8. LIBOR = London interbank offer rate
9. OIS = overnight indexed swap
10. CDS = credit-default-swap(s)
11. CCP = central counterparty or central clearing counterparty
12. MBS = mortgage-backed-security(securities)
13. CDO = collateralized debt obligation(s)
14. ERM = enterprise risk management
15. RAROC = risk-adjusted return on capital
16. bp(s) = basis point(s)
17. The CEO, CFO, CIO, and CRO are the chief executive, financial, investment, and risk officers, respectively.
18. The following acronyms are used for selected currencies:

Acronym	Currency
AUD	Australian dollar
CAD	Canadian dollar
CNY	Chinese yuan
EUR	euro
GBP	British pound sterling

Acronym	Currency
INR	Indian rupee
JPY	Japanese yen
MXN	Mexican peso
SGD	Singapore dollar
USD	US dollar

2017 FRM Part I Practice Exam – Candidate Answer Sheet

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1. An investment bank with an active position in commodity futures is using the peaks-over-threshold (POT) methodology for estimating VaR and ES. The bank's risk managers have set a threshold level of 3.00% to evaluate excess losses. The choice of the threshold, they argue, is suitable and consistent with the finding that 5.00% of the observations are in excess of the threshold value. The risk managers have concluded that the position's VaR using the POT measure is 4.45% at 99% confidence level. The VaR estimate incorporates the following assumptions generated from the managers' empirical analysis:

Parameter	**Symbol**	**Value**
Loss threshold	u	3%
Number of observations	N	740
Number of observations that exceed threshold	n	37
Scale	β	0.75
Shape (tail index)	ε	0.22

Given the VaR value and the parameter assumptions, which of the following is correct?

A. Increasing the value of the tail index lowers both the ES and the VaR
B. Increasing the loss threshold level increases both the ES and the VaR
C. The value of ES is 4.57%
D. The value of ES is 5.71%

2. A risk manager is estimating the market risk of a portfolio using both the normal distribution and the lognormal distribution assumptions. The manager gathers the following data on the portfolio:

- Annual mean: 15%
- Annual volatility: 35%
- Current portfolio value: EUR 4,800,000
- Trading days in a year: 252

Which of the following statements is correct?

A. Lognormal 95% VaR is less than normal 95% VaR at the 1-day holding period by 0.13%
B. Lognormal 95% VaR is less than normal 95% VaR at the 1-year holding period by 7.91%
C. Lognormal 99% VaR is less than normal 99% VaR at the 1-day holding period by 1.43%
D. Lognormal 99% VaR is less than normal 99% VaR at the 1-year holding period by 13.86%

3. A risk team at an investment bank uses the KMV model to estimate the distance to default and expected default frequency in evaluating default conditions of both potential and existing client firms. One such client currently has total assets valued at USD 20 billion, asset volatility of 28% per annum, short-term debt of USD 7 billion, and long-term debt of USD 6 billion. The expected return on the firm's assets is 5% per year and the risk free rate is 1% per year. The firm does not pay any dividends. The rating schedule at a 1-year horizon is shown in the table below:

Expected Default Frequency (EDF)	Rating Class
0.02% – 0.04%	AAA
0.04% – 0.10%	AA/A
0.10% – 0.19%	A/BBB+
0.19% – 0.40%	BBB+/BBB-
0.40% – 0.72%	BBB-/BB
0.72% – 1.01%	BB/BB-

What is the suggested credit rating of the firm at a 1-year horizon using the rating schedule provided?

A. AA/A
B. A/BBB+
C. BBB+/BBB-
D. BBB-/BB

4. A risk manager is comparing the use of parametric and non-parametric approaches for calculating VaR and is concerned about some of the characteristics present in the loss data. Which of the following conditions would make non-parametric approaches the favored method to use?

A. Scarcity of high magnitude loss event
B. Skewness in the distribution
C. Unusually high volatility during the data period
D. Unusually low volatility during the data period

5. LMT Bank has entered into a 1-year CDS contract with an endowment fund. According to the contract, LMT Bank will pay the endowment fund 75% of the face value of a bond issued by GTE Chemical Corporation immediately after a default by GTE Chemical. To purchase this CDS, the endowment fund will pay LMT Bank the CDS spread, which is a percentage of the face value, once at the end of the year. LMT Bank estimates that the risk-neutral default probability for GTE Chemical is 6% per year. The risk-free rate is 3% per year. Assuming defaults can only occur halfway through the year and that the accrued premium is paid immediately after a default, what is the estimate for the CDS spread?

A. 457 basis points
B. 471 basis points
C. 468 basis points
D. 628 basis points

6. A risk analyst at a mid-size hedge fund is evaluating the credit risk of several trade positions. The hedge fund specializes in corporate debt and runs a strategy that utilizes both relative value and long-only trades using CDS and bonds. One of the new trades at the hedge fund is a BBB-rated long bond valued at JPY 10 billion. Some of the hedge fund's newest clients, including the BBB-rate bond holders, are restricted from withdrawing their funds for four years. The analyst is currently evaluating the impact of various default scenarios to estimate future asset liquidity. The analyst has estimated that the marginal probability of default of the BBB-rated bond is 5% in Year 1, 8% in Year 2, 15% in Year 3, and 24% in Year 4. What is the probability that the bond makes coupon payments for 4 years and then defaults at the end of Year 4?

A. 7.6%
B. 13.1%
C. 17.8%
D. 20.4%

7. MDM Bank is seeking to enhance its enterprise risk management function. In order to achieve that objective the bank introduces a new decision-making process based on economic capital that involves assessing sources of risk across different business units and organizational levels. Which of the following statements regarding the correlations between these risks is correct?

A. Correlations between business units are only relevant in deciding total firm-wide economic capital levels and are not relevant for decisions at the individual business unit or project level.
B. Correlations between broad risk types such as credit, market, and operational risk are generally well understood and are easy to estimate at the individual firm level.
C. The introduction of correlations into firm-wide risk evaluation will result in a total VaR that, in general, is greater than or equal to the sum of individual business unit VaRs.
D. The introduction of correlations into the risk evaluation of a bank's loan book will result in total credit VaR that, in general, is less than or equal to the sum of individual loan credit VaRs.

8. A pension fund has reported that its assets and liabilities were valued at USD 840 million and USD 450 million, respectively, at year-end 2015. The assets were fully invested in equities and commodities. The fund's liabilities, constituted entirely by fixed-income obligations, had a modified duration of 12 years. In 2016, the global slump in commodity prices affected the pension fund assets, specifically causing its investment in equities and commodities to lose 30% of their market value. However, the surprising monetary policy action of the government that led to the increase in interest rates had a positive effect on the performance of fixed-income securities, causing yields on the fund's liabilities to rise by 2.3%. What was the change in the pension fund's surplus in 2016?

A. USD -325.8 million
B. USD -127.8 million
C. USD 262.2 million
D. USD 390.0 million

9. A wealth management firm has a portfolio consisting of USD 48 million invested in US equities and USD 35 million invested in emerging markets equities. The 1-day 95% VaR for each individual position is USD 1.2 million. The correlation between the returns of the US equities and emerging markets equities is 0.36. While rebalancing the portfolio, the manager in charge decides to sell USD 8 million of the US equities to buy USD 8 million of the emerging markets equities. At the same time, the CRO of the firm advises the portfolio manager to change the risk measure from 1-day 95% VaR to 10-day 99% VaR. Assuming that returns are normally distributed and that the rebalancing does not affect the volatility of the individual equity positions, by how much will the portfolio VaR increase due to the combined effect of portfolio rebalancing and change in risk measure?

A. USD 6.870 million
B. USD 8.248 million
C. USD 11.270 million
D. USD 12.482 million

10. The board of directors at Bank PQP is evaluating a proposal by senior management to restructure the operations of the bank. Of key concern is the future of the bank's consumer lending division, which has a loan portfolio amounting to EUR 180 million. The bank funds the division predominantly using unstable retail and wholesale deposits. In analyzing the credit risk condition of the division, management determines that the probability of default is 8%, the loss given default is 70%, and the exposure at default is 100% of the loan exposure. The CEO is arguing that the risk capital that has been set aside to support consumer lending, in line with the bank's stated risk appetite, is too high compared to the performance of the other business divisions. The bank applies the same hurdle rate and effective tax rate across all business lines, and a 1-year horizon to measure parameters whose values are shown in the table below:

Item	**Value**
Consumer Lending Division:	
Economic capital	EUR 135.0 million
Return on the loan portfolio	14.0%
Return on risk capital	3.0%
Cost of debt capital	6.0%
Operating direct costs	EUR 1.595 million
Transfers	EUR 0.0 million
Bank PQP:	
Hurdle rate	8.0%
Equity market return	7.0%
Risk-free rate	3.0%
Equity beta	1.05
Effective tax rate	32.0%

Assuming earnings correlations between the various divisions are the same and the main objective of each division is to add value for the bank's shareholders, which of the following recommendations of the board is correct?

A. Close down the consumer lending division because the adjusted RAROC is less than the risk-free rate

B. Close down the consumer lending division because RAROC is less than the hurdle rate

C. Keep the consumer lending division because the adjusted RAROC is greater than the risk-free rate

D. Keep the consumer lending division because RAROC is greater than the hurdle rate

11. A credit manager who is well versed in lessons learned from the 2007–2009 subprime mortgage crisis in the US is overseeing the structured credit book of a bank in order to identify potential frictions in the securitization process. Which of the following is a correct combination of a potential friction in the securitization process and an appropriate mechanism to mitigate that friction?

- **A.** Friction between the asset manager and the investor: Adverse selection problem. This problem can be mitigated by the asset manager charging due diligence fees to the investor.
- **B.** Friction between the arranger and the originator: Model error problem. This problem can be mitigated by the arranger providing a credit enhancement to the securities with its own funding.
- **C.** Friction between the investor and credit rating agencies: Principal-agent conflict. This problem can be mitigated by requiring credit rating agencies to be paid by originators and not by investors for their rating services.
- **D.** Friction between the servicer and the mortgagor: Moral hazard problem. This problem can be mitigated by requiring the mortgagor to escrow funds for insurance and tax payments.

12. A risk manager is backtesting a company's 1-day 99.5% VaR model over a 1-year horizon at a 95% confidence level. Assuming 250 days in a year, what is the maximum number of daily losses exceeding the 1-day 99.5% VaR that is acceptable to conclude that the model is calibrated correctly?

- **A.** 3
- **B.** 5
- **C.** 15
- **D.** 19

13. A portfolio manager is mapping a fixed-income portfolio into exposures on selected risk factors. The manager is analyzing the comparable mechanics and risk measurement outputs of principal mapping, duration mapping, and cash-flow mapping that correspond to the average portfolio maturity. Which of the following is correct?

- **A.** Principal mapping considers coupon and principal payments, and the portfolio VaR using principal mapping is greater than the portfolio VaR using cash-flow mapping.
- **B.** Duration mapping does not consider intermediate cash flows and the portfolio VaR using duration mapping is less than the portfolio VaR using principal mapping.
- **C.** Cash-flow mapping considers the timing of the redemption cash flow payments only, and the portfolio VaR using cash flow mapping is less than the portfolio VaR using duration mapping.
- **D.** Cash-flow mapping considers the present values of cash flows grouped into maturity buckets, and the undiversified portfolio VaR using cash-flow mapping is greater than the portfolio VaR using principal mapping.

14. A CRO of a hedge fund is asking the risk team to develop a term-structure model that is appropriate for fitting interest rates for use in the fund's options pricing practice. The risk team is evaluating among several interest rate models with time-dependent drift and time-dependent volatility functions. Which of the following is a correct description of the specified model?

A. In the Ho-Lee model, the drift of the interest rate process is presumed to be constant.
B. In the Ho-Lee model, when the short-term rate is above its long-run equilibrium value, the drift is presumed to be negative.
C. In the Cox-Ingersoll-Ross model, the basis-point volatility of the short-term rate is presumed to be proportional to the square root of the rate, and short-term rates cannot be negative.
D. In the Cox-Ingersoll-Ross model, the volatility of the short-term rate is presumed to decline exponentially to a constant level.

15. A portfolio strategist for a hedge fund is looking to mitigate counterparty credit risk exposure to LLG, an A-rated firm. Currently the hedge fund has the following derivative contracts with firm LLG:

Contract	Contract Value (SGD)
X	20,000,000
Y	40,000,000
Z	16,000,000
W	1,500,000

Given the information, what is the most appropriate credit risk mitigation technique that the hedge fund should use in this case?

A. Implement a netting scheme.
B. Use credit triggers.
C. Sell credit default swaps on LLG.
D. Increase collateral.

16. A mid-sized investment bank conducts several trades. As part of its risk control, it has entered into netting agreements on 8 equity trade positions with an average correlation of 0.28. The firm believes that it can improve upon the diversification benefit of netting by a judicious choice of number of exposures with a favorable correlation coefficient. Which of the following trade combinations would increase the firm's expected netting benefit the most from the current level?

Trade Combination	Number of Positions	Average Correlation
ABC	4	0.25
LMN	7	0.15
PQR	13	–0.06
TUV	15	–0.04

A. Trade combination ABC
B. Trade combination LMN
C. Trade combination PQR
D. Trade combination TUV

17. A portfolio manager is interested in acquiring Stock GIL as part of an existing portfolio. However, the manager is concerned about the level of liquidity risk and proceeds to estimate liquidity adjusted VaR for the stock. The manager observes a quote for Stock GIL and reports that the midpoint of its current best bid and best ask prices is AUD 66. Stock GIL has an estimated daily return volatility of 0.27% and average bid-ask spread of AUD 0.18. Using the constant spread approach on a 30,000 share position and assuming the returns of Stock GIL are normally distributed, what is the correct estimate for the stock's liquidity-adjusted 1-day 99% VaR?

A. AUD 2,700
B. AUD 5,400
C. AUD 12,400
D. AUD 15,100

18. A manager is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at CNY 136 million and contains CNY 12 million in stock Y. The standard deviation of returns of stock Y is 18% annually and that of the overall portfolio is 23% annually. The correlation of returns between stock Y and the portfolio is 0.42. Assuming the risk analyst uses a 1-year 95% VaR and that returns are normally distributed, how much is the component VaR of stock Y?

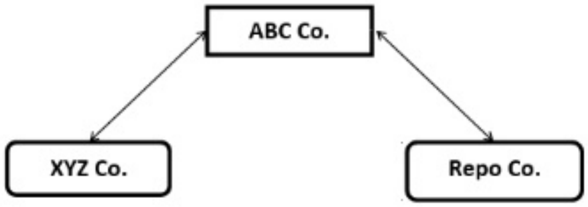
A. CNY 0.817 million
B. CNY 1.492 million
C. CNY 2.110 million
D. CNY 3.553 million

QUESTIONS 19 AND 20 REFER TO THE FOLLOWING INFORMATION

XYZ, a small investment management firm, specializes in structuring small business loans and selling the government guaranteed portion to other institutional investors while retaining the riskier portions for high net worth investors. XYZ funds its operations by engaging in overnight repurchase agreements (repos) with three firms, but primarily with ABC, a firm that specializes in pooling funds from community banks and local government agencies and investing them in short-term, high-quality, government-secured investments.

Last week, XYZ was informed by ABC that its line had been frozen. XYZ learned that ABC had been defrauded by Repo Co., another repo borrower, who had provided false documentation of non-existent collateral of government-guaranteed loans. ABC feared a run by its investors as news of the fraud spread.

The diagram below illustrates the parties involved:



19. The use of a central clearinghouse to handle the transactions executed between XYZ's main funding source, ABC and ABC's client, Repo Co., would likely have resulted in a reduction in:

A. ABC's funding liquidity risk.
B. Repo Co.'s default risk.
C. XYZ's lending risk.
D. ABC's operational risk.

20. By using a clearinghouse to handle the repo transactions between ABC and Repo Co., obligations owed between the two could have been netted once the fraudulent documentation was discovered. Which of the following is the most appropriate type of netting to use in this situation and what would be a likely additional impact from using this netting?

A. Payment netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
B. Payment netting would be used, which would reduce Repo Co.'s counterparty risk, but ABC's counterparty risk would be increased.
C. Closeout netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
D. Closeout netting would be used, which would reduce Repo Co.'s counterparty risk, but ABC's counterparty risk would be increased.

21. A risk analyst at a fund management company is discussing with the risk team the gaps in the company's risk measurement system. Among the issues they have identified is the understanding that failing to anticipate cash flow needs is one of the most serious errors that a firm can make. Addressing such a problem demands that a good liquidity-at-risk (LaR) measurement system be an essential part of the bank's risk management framework. Which of the following statements concerning LaR is correct?

A. A firm's LaR tends to decrease as its credit quality declines.
B. For a hedged portfolio, the LaR can differ significantly from the VaR.
C. Hedging using futures has the same impact on LaR as hedging using long option positions.
D. Reducing the basis risk through hedging decreases LaR.

22. Pillar 1 of the Basel II framework allows banks to use various approaches to calculate the capital requirements for credit risk, operational risk, and market risk. Which of the following Basel II approaches allows a bank to explicitly recognize diversification benefits?

A. The basic indicator approach for operational risk
B. The internal ratings based approach for credit risk
C. The internal models approach for market risk
D. The standardized approach for operational risk

23. The risk audit committee of a mutual fund is reviewing a portfolio construction technique proposed by a new portfolio manager. The manager has recently been allocated capital to manage for an equity risk class. The Fund typically grants its portfolio managers flexibility in selecting and implementing appropriate portfolio construction procedures but requires that any methodology adopted fulfils key risk control objectives set by the firm. Which of the following portfolio construction techniques and its capability for risk control in portfolio construction is correct?

A. Quadratic programming allows for risk control through parameter estimation but generally requires many more inputs estimated from market data than other methods require.
B. The screening technique provides superior risk control by concentrating stocks in selected sectors based on expected alpha.
C. When using the stratification technique, risk control is implemented by overweighting the categories with lower risks and underweighting the categories with higher risks.
D. When using the linear programming technique, risk is controlled by selecting the portfolio with the lowest level of active risk.

24. An analyst reports the following fund information to the advisor of a pension fund that currently invests in government and corporate bonds and carries a surplus of USD 10 million:

Pension	Assets	Liabilities
Amount (USD million)	180	140
Expected annual growth rate	6%	10%
Modified duration	14	8
Annual volatility of growth	25%	12%

To evaluate the sufficiency of the fund's surplus, the advisor estimates the possible surplus values at the end of one year. The advisor assumes that annual returns on assets and the annual growth of the liabilities are jointly normally distributed and their correlation coefficient is 0.68. The advisor can report that, with a confidence level of 95%, the surplus value will be greater than or equal to:

A. USD -58.2 million
B. USD -22.0 million
C. USD 1.0 million
D. USD 21.0 million

25. A due diligence specialist at a company is evaluating the risk management process of a hedge fund in which the company is considering making an investment. Which of the following statements best describes criteria used for such an evaluation?

A. Because of the overwhelming importance of tail risk, the company should not invest in the fund unless it fully accounts for fat tails using extreme value theory at the 99.99% level when estimating VaR.
B. Today's best practices in risk management require that a fund employ independent risk service providers and that these service providers play important roles in risk-related decisions.
C. When considering a leveraged fund, the specialist should assess how the fund estimates risks related to leverage, including funding liquidity risks during periods of market stress.
D. It is crucial to assess the fund's valuation policy, and in general if more than 10% of asset prices are based on model prices or broker quotes, the specialist should recommend against investment in the fund regardless of other information available about the fund.

26. A packaging materials manufacturer is considering a project that has an estimated risk-adjusted return on capital (RAROC) of 15%. Suppose that the risk-free rate is 3% per year, the expected market rate of return is 11% per year, and the company's equity beta is 1.8. Using the criterion of adjusted risk-adjusted return on capital (ARAROC), the company should:

A. Reject the project because the ARAROC is higher than the market expected excess return.
B. Accept the project because the ARAROC is higher than the market expected excess return.
C. Reject the project because the ARAROC is lower than the market expected excess return.
D. Accept the project because the ARAROC is lower than the market expected excess return.

27. A derivative trading firm only trades derivatives on rare commodities. The company and a handful of other firms, all of whom have large notional outstanding contracts with the company, dominate the market for such derivatives. The company's management would like to mitigate its overall counterparty exposure, with the goal of reducing it to almost zero. Which of the following methods, if implemented, could best achieve this goal?

A. Ensuring that sufficient collateral is posted by counterparties
B. Diversifying among counterparties
C. Cross-product netting on a single counterparty basis
D. Purchasing credit derivatives, such as credit default swaps

28. ADB Banking Corporation, a frequent user of swaps, often enters into transactions with HIP Bank, a major provider of swaps. Recently, HIP Bank was downgraded from a rating of A to a rating of A-, while ADB Banking Corporation was downgraded from a rating of A- to a rating of BBB. During this time, the credit spread for HIP Bank has increased from 36 bps to 144 bps, while the credit spread for ADB Banking has increased from 114 bps to 156 bps. Which of the following is the most likely action that the counterparties will request on their credit value adjustment (CVA)?

A. The credit qualities of the counterparties have migrated, but not significantly enough to justify amending existing CVA arrangements.
B. HIP Bank requests an increase in the CVA charge it receives.
C. ADB Banking Corporation requests a reduction in the CVA charge it pays.
D. CVA is no longer a relevant factor, and the counterparties should migrate to using other mitigants of counterparty risk.

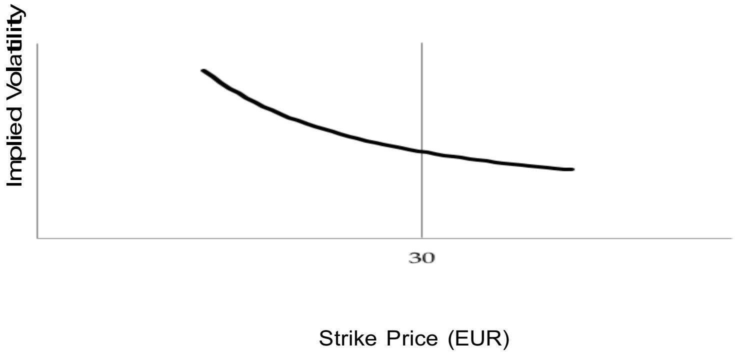
29. A risk analyst estimates that the hazard rate for a company is 0.1 per year. The probability of survival in the first year followed by a default in the second year is closest to:

A. 8.6%.
B. 9.5%.
C. 18.1%.
D. 21.1%.

30. Computing VaR on a portfolio containing a very large number of positions can be simplified by mapping these positions to a smaller number of elementary risk factors. Which of the following is correct?

A. USD/EUR forward contracts are mapped on the USD/EUR spot exchange rate.
B. Each position in a corporate bond portfolio is mapped on the bond with the closest maturity among a set of government bonds.
C. Zero-coupon government bonds are mapped on government bonds paying regular coupons.
D. A position in the stock market index is mapped on a position in a stock within that index.

31. A risk manager is in the process of valuing several European-type option positions on a non-dividend-paying stock XYZ that is currently priced at EUR 30. The implied volatility skew, estimated using the Black-Scholes-Merton model and the current prices of actively traded European-style options on stock XYZ at various strike prices, is shown below:



Assuming that the implied volatility at EUR 30 is used to conduct the valuation, which of the following long positions will be overvalued?

A. An in-the-money call
B. An in-the-money put
C. An out-of-the-money call
D. An out-of-the-money put

32. A financial analyst is pricing a 5-year call option on a 5-year Treasury note using a successfully tested pricing model. Current interest rate volatility is high and the analyst is concerned about the effect this may have on short-term rates when pricing the option. Which of the following actions would best address the potential for negative short-term interest rates to arise in the model?

A. When short-term rates are negative, the financial analyst adjusts the risk-neutral probabilities.
B. When short-term rates are negative, the financial analyst increases the volatility.
C. When short-term rates are negative, the financial analyst sets the rate to zero.
D. When short-term rates are negative, the financial analyst sets the mean-reverting parameter to 1.

33. An investment bank has been using VaR as its main risk measurement tool. ES is suggested as a better alternative to use during market turmoil. What should be understood regarding VaR and ES before modifying current practices?

A. Compared to VaR, ES leads to more required economic capital for the same confidence level.
B. If a VaR backtest at a specified confidence level is accepted, then the corresponding ES will always be accepted.
C. While VaR ensures that the estimate of portfolio risk is less than or equal to the sum of the risks of that portfolio's positions, ES does not.
D. While ES is more complicated to calculate than VaR, it is easier to backtest than VaR.

QUESTION 34 REFERS TO THE FOLLOWING INFORMATION

A derivative trading desk at a bank decides that its existing VaR model, which has been used broadly across the firm for several years, is too conservative. The existing VaR model uses a historical simulation over a three-year look-back period, weighting each day equally. A quantitative analyst in the group quickly develops a new VaR model, which uses the delta normal approach. The new model uses volatilities and correlations estimated over the past four years using the RiskMetrics EWMA method.

For testing purposes, the new model is used in parallel with the existing model for six weeks to estimate the 1-day 99% VaR. After six weeks, the new VaR model has no exceedances despite consistently estimating VaR to be considerably lower than the existing model's estimates. The analyst argues that the lack of exceedances shows that the new model is unbiased and pressures the bank's model evaluation team to agree. Following an overnight examination of the new model by one junior analyst instead of the customary evaluation that takes several weeks and involves a senior member of the team, the model evaluation team agrees to accept the new model for use by the desk.

34. Which of the following statements about the risk management implications of this replacement is correct?

A. Delta-normal VaR is more appropriate than historical simulation VaR for assets with non-linear payoffs.
B. Changing the look-back period and weighing scheme from three years, equally weighted, to four years, exponentially weighted, will understate the risk in the portfolio.
C. The desk increased its exposure to model risk due to the potential for incorrect calibration and programming errors related to the new model.
D. A 99% VaR model that generates no exceedances in six weeks is necessarily conservative.

35. A hedge fund has a 25,000 share position in an undervalued and relatively illiquid stock XYZ that has a current stock price of GBP 48 (expressed as the midpoint of the current bid-ask spread). The daily return for XYZ has a mean of 0%, an estimated volatility of 0.32%, and a volatility spread of 0.0016. The average bid-ask spread is GBP 0.22. The risk division of the fund usually assumes that the returns are normally distributed and estimates the liquidity adjusted 1-day 95% VaR of the position using the constant spread approach. Suppose that the CRO asks the risk division to determine the liquidity adjusted 1-day 95% VaR using the exogenous spread approach instead. Assuming the volatility spread multiplier k of 3, what would be the increase in the liquidity adjustment?

A. 43.65%
B. 45.71%
C. 69.61%
D. 89.36%

36. The Basel Committee recommends that banks use a set of early warning indicators in order to identify emerging risks and potential vulnerabilities in their liquidity position. Which of the following is an early warning indicator of a potential liquidity problem?

A. Credit rating upgrade
B. Increased asset diversification
C. Rapid asset growth
D. Positive publicity

37. Large dealer banks have often financed significant fractions of their assets using short-term (overnight) repurchase agreements in which creditors hold bank securities as collateral against default losses. The table below shows the quarter-end financing of four broker-dealer financial instruments. All values are in USD billions.

	Bank P	**Bank Q**	**Bank R**	**Bank S**
Financial Instruments Owned	656	750	339	835
Pledged as collateral	258	472	139	209
Not pledged	398	278	200	626

In the event that repo creditors become equally nervous about each bank's solvency, which bank is most vulnerable to a liquidity crisis?

A. Bank P
B. Bank Q
C. Bank R
D. Bank S

38. During a training seminar, a supervisor at Firm W discusses different types of operational risk that the firm may face, which could be in the short-term or over the long-term period. Which of the following is an example of an operational risk loss by Firm W?

A. After a surprise announcement by the central bank that interest rates would increase, bond prices fall, and Firm W incurs a significant loss on its bond portfolio.
B. The data capture system of Firm W fails to capture the correct market rates causing derivative trades to be done at incorrect prices, leading to significant losses.
C. As a result of an increase in commodity prices, the share price of a company that Firm W invested in falls significantly, causing major investment losses.
D. A counterparty of Firm W fails to settle their debt to Firm W, and in doing this, they are in breach of a legal agreement to pay for services rendered.

39. The risk management group estimates the 1-day 99% VaR on a long-only, large-cap equity portfolio using a variety of approaches. A daily risk report shows the following information:

Approach	**1-day 99% VaR (EUR)**
Delta-Normal	300,000
Monte Carlo Simulation	332,000
Historical Simulation	366,000

Which of the following is the most likely explanation for the variation in VaR estimates?

A. Data problems
B. Differences in model assumptions
C. Endogenous model risk
D. Programming errors

40. A risk analyst is building a bank's enterprise risk management system. During the process, the analyst takes an inventory of firm risks and categorizes these risks as market, credit, or operational. Which of the following observations of the bank's data should be considered unexpected if compared to similar industry data?

A. The operational risk loss distribution has a large number of small losses, and therefore a relatively low mode.
B. The operational risk loss distribution is symmetric and fat-tailed.
C. The credit risk distribution is asymmetric and fat-tailed.
D. The market risk distribution is similar to the distribution of the return on a portfolio of securities.

41. A regional commercial bank is considering a loan to be fully funded entirely by deposits, with the following parameters:

- Loan amount: JPY 3.2 billion
- Average annual interest rate paid on deposits: 0.6%
- Annual interest rate on loan: 4.5%
- Expected loss: 3.0% of face value of loan
- Annual operating costs: 0.3% of face value of loan
- Economic capital need: 8.5%
- Average return on economic capital: 1.2%
- Effective tax rate: 34.0%

What is the risk-adjusted after-tax return on capital (RAROC) for this loan?

A. 1.2%
B. 1.8%
C. 14.0%
D. 21.2%

42. A bank uses VaR and stressed VaR market risk framework in line with the Basel requirements. The bank's internal models for market risk have generated the following risk measures (in USD million) for the current trading book positions:

Confidence Level	**Latest Available 10-day VaR**	**Latest Available 10-day Stressed VaR**	**Average 10-day VaR of Previous 60 Days**	**Average 10-day Stressed VaR of Previous 60 Days**
95.0%	228	498	255	557
99.0%	441	1,009	416	1,117
99.9%	568	1,295	531	1,383

Assuming the supervisory authority has set the multiplication factors for both the VaR and stressed VaR values to 3, what is the correct capital requirement for general market risk for the bank?

A. USD 1,248 million
B. USD 1,533 million
C. USD 4,350 million
D. USD 4,599 million

43. Company OBD has an outstanding zero-coupon bond with 1 year remaining to maturity. The bond has a face value of USD 1,000,000 and a recovery rate of 0%. The bond is currently trading at 84% of face value. Assuming the excess spread only captures credit risk and that the risk-free rate is 2.5% per annum, what is the approximate risk-neutral 1-year probability of default of Company OBD?

A. 12%
B. 14%
C. 17%
D. 19%

44. An insurance company is considering taking positions in various tranches of a collateralized debt obligation (CDO). The company's CRO predicts that the default probability will decrease significantly and that the default correlation will increase. Based on this prediction, which of the following is a good strategy to pursue?

A. Buy the senior tranche and buy the equity tranche.
B. Buy the senior tranche and sell the equity tranche.
C. Sell the senior tranche and sell the equity tranche.
D. Sell the senior tranche and buy the equity tranche.

45. A financial institution has many open derivative positions with an investment company. A description and current market values are displayed in the table below:

Position	Price (USD)
Long swaptions	29 million
Long credit default swaps	11 million
Short currency derivatives	18 million
Short interest rate swaps	7 million

In the event that the investment company defaults, what would be the loss to the financial institution if netting is used compared to the loss if netting is not used?

A. Loss of USD 11 million if netting is used; loss of USD 25 million if netting is not used
B. Loss of USD 11 million if netting is used; loss of USD 40 million if netting is not used
C. Loss of USD 15 million if netting is used; loss of USD 25 million if netting is not used
D. Loss of USD 15 million if netting is used; loss of USD 40 million if netting is not used

46. A derivative trading firm sells a European-type call option on stock JKJ with a time to expiration of 9 months, a strike price of EUR 45, an underlying asset price of EUR 67, and implied annual volatility of 27%. The annual risk-free interest rate is 2.5%. What is the firm's counterparty credit exposure from this transaction?

A. EUR 0.00
B. EUR 9.45
C. EUR 19.63
D. EUR 22.00

47. An endowment fund has sold default protection on the most senior tranche of a CDO. If the default correlation between assets held in the CDO decreases sharply, assuming everything else is unchanged, how will the position of the endowment fund be impacted?

A. It will either increase or decrease, depending on the pricing model used and the market conditions.
B. It will gain significant value, since the probability of exercising the protection falls.
C. It will lose significant value, since the protection will gain value.
D. It will neither gain nor lose value, since only expected default losses matter and correlation does not affect expected default losses.

48. A hedge fund manages a portfolio of equity options. Among them are options written by a financial institution on its own stock. Assuming the financial institution could write one of the following options, which option would give the highest wrong-way risk?

A. An in-the-money call option
B. An in-the-money call option
C. An out-the-money call option
D. An out-the-money call option

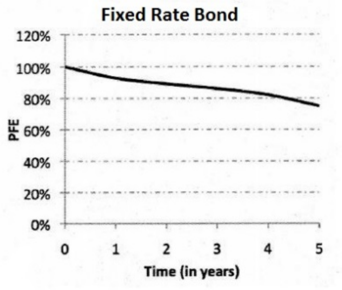
49. Four derivative counterparties have undertaken bilateral netting arrangements. The exhibit below presents a summary of their bilateral mark-to-market (MtM) trades. If netting agreements exist between all pairs of counterparties shown, what is the correct order of net exposure per counterparty, from highest to lowest?

Mark-to-Market Trades for Four Counterparties (USD million)				
		Opposing Counterparty		
		Q	**R**	**S**
Counterparty **P**	Trades with positive MtM	8	10	4
	Trades with negative MtM	-6	-2	-4
		P	**R**	**S**
Counterparty **Q**	Trades with positive MtM	15	6	7
	Trades with negative MtM	-16	0	-8
		P	**Q**	**S**
Counterparty **R**	Trades with positive MtM	6	4	8
	Trades with negative MtM	-6	-5	-12
		P	**Q**	**R**
Counterparty **S**	Trades with positive MtM	2	13	1
	Trades with negative MtM	-2	-10	-1

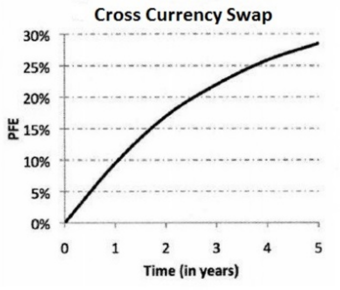
A. P, Q, S, R
B. Q, R, S, P
C. R, Q, P, S
D. S, P, Q, R

50. Interest rate and currency swaps display differing profiles of potential future exposure (PFE) over time. Which of the following graphs is an accurate representation of a typical PFE profile for the corresponding instrument?

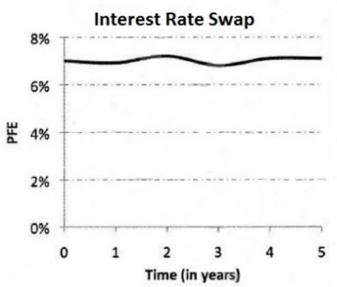
A



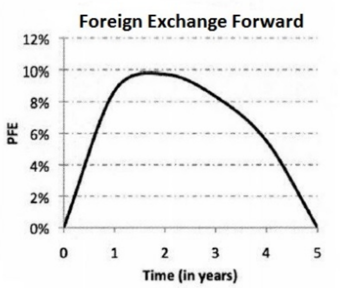
B.



C



D.



51. A risk analyst is examining a firm's foreign currency option price assumptions. The observed volatility smile for a particular foreign currency option slopes progressively higher as an option moves either into the money or out of the money. Compared to the lognormal distribution with the same mean and standard deviation, the distribution of option prices on this foreign currency implied by the Black-Scholes-Merton (BSM) model would have:

A. A heavier left tail and a less heavy right tail.
B. A heavier left tail and a heavier right tail.
C. A less heavy left tail and a heavier right tail.
D. A less heavy left tail and a less heavy right tail.

52. A wealth management firm has INR 56 billion in assets. The portfolio manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (INR)
95.0%	226,665,000
95.5%	230,197,500
96.0%	234,000,000
96.5%	244,237,500
97.0%	253,012,500
97.5%	261,787,500
98.0%	272,317,500
98.5%	286,357,500
99.0%	304,785,000
99.5%	333,157,500

What is the closest estimate of the daily ES at the 97.5% confidence level?

A. INR 262 million
B. INR 264 million
C. INR 292 million
D. INR 299 million

53. A newly hired risk analyst is backtesting a firm's VaR model. Previously, the firm calculated a 1-day VaR at the 95% confidence level. Following the Basel framework, the risk analyst is recommending that the firm switch to a 99% confidence level. Which of the following statements concerning this switch is correct?

A. The decision to accept or reject a VaR model based on backtesting results is less reliable with a 99% confidence level VaR model than with a 95% confidence level model.
B. The 95% VaR model is less likely to be rejected using backtesting than the 99% VaR model.
C. When validating with backtesting at the 90% confidence level, there is a smaller probability of incorrectly rejecting a 95% VaR model than a 99% VaR model.
D. When backtesting using a 90% confidence level, there is a smaller probability of committing a type I error when backtesting a 95% VaR model than with a 99% VaR model.

54. A hedge fund risk manager is looking at various models that are flexible enough to incorporate mean reversion and risk premium into term structure modeling. Which of the following is correct about the Vasicek model?

A. It incorporates mean reversion but not drift into the interest rate model.
B. It incorporates mean reversion into the model and allows for a risk premium as a constant or changing drift.
C. It does not incorporate risk premium and the term structure of interest rate volatility in the model is upward-sloping.
D. It does not incorporate mean reversion into the model but allows for a risk premium to be applied to interest rates that change over time.

55. A hedge fund that runs a distressed securities strategy is evaluating the solvency conditions of two potential investment targets. Currently firm RST is rated BB and firm WYZ is rated B. The hedge fund is interested in determining the joint default probability of the two firms over the next two years using the Gaussian default time copula under the assumption that a one-year Gaussian default correlation is 0.36. The fund reports that x_{BB} and x_B are mapped abscise values of the bivariate normal distribution presented in the table below, while Q and N denote the cumulative default probability and the standard normal distribution, respectively:

Default Time in Year	**Firm RST Default Probability**	**Firm RST Cumulative Default Probability $Q_{BB}(t)$**	**Firm RST Cumulative Standard Normal Percentiles $N^{-1}(Q_{BB}(t))$**	**Firm WYZ Default Probability**	**Firm WYZ Cumulative Default Probability $Q_B(t)$**	**Firm WYZ Cumulative Standard Normal Percentiles $N^{-1}(Q_B(t))$**
1	5.21%	5.21%	– 1.2104	19.06%	19.06%	– 0.5694
2	6.12%	11.33%	– 0.8586	10.63%	29.69%	– 0.2630
3	5.50%	16.83%	– 0.6443	8.24%	37.93%	– 0.0516
4	4.81%	21.64%	– 0.4893	6.10%	44.03%	– 0.1015
5	4.22%	25.86%	– 0.3672	4.03%	48.06%	– 0.2046

Applying the Gaussian copula, which of the following best describes the derivation of the joint probability(Q) that firm RST and firm WYZ will both default in year 2?

A. $Q(x_{BB} = 0.0612) + Q(x_B = 0.1063) – Q(x_{BB} = 0.0612)*Q(x_B = 0.1063)$
B. $Q(x_{BB} = 0.1133) + Q(x_B = 0.2969) – Q(x_{BB} = 0.1133)*Q(x_B = 0.2969)$
C. $Q(x_{BB} \leq 0.1133 \cap x_B \leq 0.2969)$
D. $Q(x_{BB} \leq – 0.8586 \cap x_B \leq – 0.2630)$

56. A risk committee of the board of company ABC is discussing the difference between pricing deep out-of-the-money call options on ABC stock and pricing deep out-of-the-money call options on the USD/GBP foreign exchange rate using the Black-Scholes-Merton (BSM) model. The committee considers pricing these options based on two distinct probability distributions of underlying asset prices at the option expiration date: A lognormal probability distribution, or an implied risk-neutral probability distribution obtained from the volatility smile for options of the same maturity. If the implied risk-neutral probability distribution is used, instead of the lognormal, which of the following is correct?

A. The price of the option on ABC would relatively be high and the price of the option on USD/GBP would relatively be low.
B. The price of the option on ABC would relatively be low and the price of the option on USD/GBD would relatively be high.
C. The price of the option on ABC would relatively be low and the price of the option on USD/GBD would relatively be low.
D. The price of the option on ABC would relatively be high and the price of the option on USD/GBD would relatively be high.

57. A CRO is concerned that existing internal risk models of a firm, which are governed mainly by the central limit theorem, are not adequate in addressing potential random extreme losses of the firm. The CRO then recommends the use of extreme value theory (EVT). When applying EVT and examining distributions of losses exceeding a threshold value, which of the following is correct?

A. As the threshold value is increased, the distribution of exceedances converges to a generalized Pareto distribution.
B. If the tail parameter value of the generalized extreme-value (GEV) distribution goes to infinity, then the GEV essentially becomes a normal distribution.
C. To apply EVT, the underlying loss distribution must be either normal or lognormal.
D. The number of exceedances decreases as the threshold value decreases, which causes the reliability of the parameter estimates to increase.

58. In the Basel framework, a penalty is given to banks that have more than four exceptions to their 1-day 99% VaR over the course of the last 250 trading days. Which of the following causes of exceptions is most likely to lead to a penalty?

A. A large move in interest rates was combined with a small move in correlations.
B. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.
C. A sudden market crisis in an emerging market, which leads to losses in the equity positions in that country.
D. A sudden devastating earthquake that caused major losses in the bank's key area of operation.

59. A fund manager owns a portfolio of options on a non-dividend paying stock TUV. The portfolio is made up of 7,500 deep in-the-money call options on TUV and 40,000 deep out-of-the-money call options on TUV. The portfolio also contains 20,000 forward contracts on TUV. Currently, TUV is trading at USD 76. Assuming 252 trading days in a year and the volatility of TUV is 18% per year, which of the following amounts would be closest to the 1-day VaR of the portfolio at the 99% confidence level?

A. USD 25,056
B. USD 55,122
C. USD 386,609
D. USD 875,041

60. A portfolio manager at an investment company is evaluating a two-asset portfolio under management. The risk and return data on the assets and the portfolio are shown in the table below:

Asset	**Position Value (EUR million)**	**Return Standard Deviation (%)**	**Beta**
HIJ	140	20.0	1.6
KLM	160	12.0	0.8
Portfolio	300	13.7	1.2

What is the marginal VaR of asset HIJ; the percent contribution of asset KLM VaR to portfolio VaR; and the portfolio's estimated diversified VaR at the 95% confidence level?

A. Marginal VaR of HIJ = 0.1803; percent contribution of asset KLM VaR = 42.67%; portfolio diversified VaR = USD 0 million
B. Marginal VaR of HIJ = 0.1803; percent contribution of asset KLM VaR = 74.67%; portfolio diversified VaR = USD 3.5 million
C. Marginal VaR of HIJ = 0.3606; percent contribution of asset KLM VaR = 42.67%; portfolio diversified VaR = USD 10.0 million
D. Marginal VaR of HIJ = 0.3606; percent contribution of asset KLM VaR = 74.67%; portfolio diversified VaR = USD 21.5 million

QUESTIONS 61 AND 62 REFER TO THE FOLLOWING INFORMATION

A financial risk consultant assumes that the joint distribution of returns is multivariate normal and calculates the following risk measures for a two-asset portfolio managed by a mid-sized insurance company:

Asset	Position (CNY)	Individual VaR (CNY)	Marginal VaR	VaR Contribution (CNY)
Financial	15,000,000	3,494,700	0.216	3,240,000
Energy	15,000,000	6,999,300	0.462	6,931,238
Portfolio	30,000,000	9,241,650		9,241,650

61. If the energy asset is dropped from the portfolio, what will be the reduction in portfolio VaR?

- **A.** CNY 2,242,350
- **B.** CNY 3,494,700
- **C.** CNY 5,746,950
- **D.** CNY 6,999,300

62. Suppose that the risk consultant defines risk capital of the insurance company by VaR. Assuming a market risk premium of 4.5% and a risk-free interest rate of 2.5%, what is the correct estimate for the return on risk capital on the financial asset?

- **A.** 5.7%
- **B.** 6.3%
- **C.** 7.0%
- **D.** 9.3%

63. An analyst regresses the returns of 300 stocks against the returns of a major market index. The resulting pool of 300 alphas has a residual risk of 15% and an information coefficient of 10%. If the alphas are normally distributed with a mean of 0%, roughly how many stocks have an alpha greater than 3.24% or less than -3.24%?

- **A.** 5
- **B.** 15
- **C.** 30
- **D.** 45

64. A risk analyst at an investment bank is reviewing the way performance analysis of hedge funds and real estate funds have been conducted. Each year, whenever a hedge fund stops trading, the hedge fund is removed from the database of hedge funds. Also, because of the addition of new assets to the real estate fund, the liquidity of that asset category has improved each year and trading has become more frequent. Which of the following best describes the impacts these changes have historically had on hedge fund and real estate fund analyses performed using these databases?

A. The average Sharpe ratio of hedge funds is understated and the average Sharpe ratio of real estate funds has increased.
B. The average Sharpe ratio of hedge funds is overstated and the average Sharpe ratio of real estate funds has decreased.
C. The average volatility of hedge funds is overstated and the average volatility of real estate funds has decreased.
D. The average volatility of hedge funds is understated and the average volatility of real estate funds has increased.

65. A money manager wants to invest a small amount of new capital that has recently come into a fund. The fund is benchmarked to an index and, rather than adding a new holding, the manager is considering increasing the holdings of one of the four assets whose performances, during the most recent evaluation period, are described in the following table:

Asset	**Portfolio Weight**	**Actual Return**	**Volatility of Return**	**Beta to the Index**
BDE	0.35	14%	19%	1.20
JKL	0.30	13%	18%	0.90
MNO	0.25	13%	16%	1.00
STU	0.10	10%	10%	0.80

The portfolio manager wants to select the asset that has the lowest marginal VaR as long as its Jensen's alpha is equal to or greater than the market risk premium. Assuming the risk free rate is 3% and the market return is 8%, which asset should the portfolio manager select?

A. Asset BDE
B. Asset JKL
C. Asset MNO
D. Asset STU

66. A risk analyst at an insurance company has determined that a counterparty to the company has a constant default probability of 6% per year. What is the probability of this counterparty defaulting in the third year?

A. 4.98%
B. 5.30%
C. 5.64%
D. 6.00%

67. The board of a pension fund is considering the funding risk of its defined benefit plan. Which of the following statements about the pension fund's funding risk is correct?

A. Decreases in interest rates will reduce funding risk.
B. Funding risk represents the true long-term risk to the plan sponsor.
C. The funding risk has been effectively transferred to the employees.
D. The longer the horizon for expected payouts, the lower the funding risk.

68. A portfolio manager is evaluating the risk profile for a portfolio of stocks. Currently, the portfolio is valued at CAD 10.7 million and contains CAD 2.1 million in stock SWZ. The standard deviation of returns of stock SWZ is 17% annually and that of the overall portfolio is 13% annually. The correlation of returns between stock SWZ and the portfolio is 0.4. Assuming the portfolio manager uses a 1-year 99% VaR and that returns are normally distributed, what is the estimated component VaR of stock SWZ?

A. CAD 162,972
B. CAD 234,906
C. CAD 253,992
D. CAD 332,152

69. A newly established risk division of a regional financial institution is setting up a Monte Carlo simulation methodology to estimate the firm's aggregate loss distribution. Which of the following loss frequency and loss severity distribution pairs is the most appropriate to use?

A. Binomial distribution for frequency, and Poisson distribution for severity.
B. Lognormal distribution for frequency, and Weibull distribution for severity.
C. Negative Binomial distribution for frequency, and Pareto distribution for severity.
D. Transformed Beta distribution for frequency, and Normal distribution for severity.

QUESTIONS 70 AND 71 REFER TO THE FOLLOWING INFORMATION

The CRO of Bank LGX, a non-dividend-paying US-based bank is preparing a report to the board of directors on the bank's capital adequacy and planning. Bank LGX is subject to both the Basel framework and the US banking rules governing global systemically important banks (G-SIBs). The bank claims that it was in compliance with all the capital requirements in January 2016 as all Basel III phase-ins have already occurred. The CRO is conducting the analysis for January 2017 using selected and most recent annual performance data, which are shown in the table below:

Item	Value (USD million) as of January 2017
Common equity Tier 1 (CET1) capital	1,515
Preferred stock (noncumulative)	100
Tier 2 capital	827
Risk-weighted assets	26,395
Total assets	42,828
Total exposure	47,460

The CRO also reports the minimum regulatory capital requirements under the revised capital framework as presented in the table below. The capital ratios also include the capital conservation buffer of 2.5% (phased-in in annual increments of 0.75%, starting January 2016) and a G-SIB surcharge of 3.0% (phased-in in annual increments of 0.625%, starting January 2016) of risk-weighted assets to be reached by January 2019:

	January 2016 Minimum Ratio	January 2017 Minimum Ratio	January 2018 Minimum Ratio	January 2019 Minimum Ratio
Capital conservation buffer	0.625%	1.25%	1.875%	2.5%
G-SIB surcharge	0.75%	1.5%	2.25%	3.0%
CET 1 ratio	4.5%	5.25%	6.5%	10.0%
Tier 1 capital ratio	6.0%	6.75%	8.0%	11.5%
Total capital ratio	8.0%	8.75%	11.5%	13.5%
Leverage ratio	4.0%	4.0%	4.0%	4.0%

70. Given the regulatory benchmark and the bank's performance, which of the capital requirements does Bank LGX satisfy as of January 2017?

A. CET1 capital ratio only
B. Leverage ratio only
C. Tier 1 capital ratio and Leverage ratio only
D. Total capital ratio and CET1 capital ratio only

71. In viewing the results of this capital analysis report and other considerations for Bank LGX's capital planning, which of the following conclusions is correct?

A. The capital conservation buffer can be met by an increase in Tier 2 capital.

B. If the exposure on derivative asset positions decreases, holding other factors constant, Total capital ratio would decrease.

C. The increase in the credit valuation adjustment (CVA) due to the bank's asset counterparty positions would tend to raise the bank's risk-weighted assets.

D. If the bank raises additional CET 1 capital and invests the same amount in gold, Bank LGX's net stable funding ratio (NSFR) will not change.

QUESTIONS 72 THROUGH 75 REFER TO THE FOLLOWING INFORMATION

In a surprise monetary policy action on August 10, 2015, the People's Bank of China cut its daily currency reference rate against the USD, resulting in a large devaluation of the CNY versus the USD. Immediately after the announcement, the CRO of CMM Bank (CMM), an international bank with headquarters in Shanghai, began evaluating the impact of this and other events on the bank's position.

CMM had outstanding long-term debt denominated in USD and deposits denominated in CNY. A significant portion of CMM's lending portfolio was also denominated in CNY and consisted largely of loans and lines of credit to Chinese manufacturers who were heavily dependent on imported raw materials. Other loans to non-Chinese firms with exposure to China were denominated in USD. The bank's portfolio investments included CNY-denominated Chinese Treasury securities and other sovereign debt.

A portion of CMM's retail customer base had invested on margin in the Chinese equity markets. Over the next few weeks, local stock markets experienced declines in share prices. Many of CMM's larger retail depositors experienced margin calls and had begun to draw down demand deposits to meet them. Offsetting these outflows, however, were increases in the 3-month, 6-month and 9-month term deposit balances at CMM of several large corporate customers. The result was that CMM's overall net deposit flow had been approximately zero.

As a result of credit developments elsewhere in the world, several of CMM's sovereign debt holdings were downgraded, some from AA to A and some from A to BBB. One of the noticeable outcomes was that the bid-ask spreads on many of the sovereign bonds held and traded by CMM widened. Despite these developments, CMM's sovereign debt portfolio remained exclusively investment grade with a weighted average rating of A+.

72. CMM's CRO was concerned about the bank's liquidity position and decided to review the impact of the devaluation and other capital market events on its net stable funding ratio (NSFR). Ignoring any changes in the market value of CMM's sovereign debt holdings, which of the following is correct?

A. The NSFR will not be impacted by the sovereign credit rating changes because the overall sovereign debt portfolio remains investment grade.
B. The NSFR will be reduced by the sovereign credit rating changes but this effect can be offset by selling A-rated sovereign debt and investing the proceeds in gold.
C. The NSFR will not be impacted by the change in demand deposits because the bank's overall deposit level is unchanged.
D. The NSFR will be reduced by the change in demand deposits but this effect can be offset by issuing common stock.

73. Before the devaluation, CMM's trading desk had established a short call options position on the CNY-USD exchange rate that was made delta-neutral through a spot USD transaction. The position was no longer delta-neutral after the devaluation came into effect and the desk wanted to take steps to make it delta-neutral again. The bank was concerned about whether this would involve buying or selling USD and what impact this might have on liquidity. The trader who initiated the position suggested that, once it was made delta-neutral, the short call options position would be an effective way to hedge the bank's long CNY exposure against further devaluations and that the bank should consider increasing the size of the position accordingly. In considering this situation, what should the CRO conclude?

A. The bank will have to buy USD to make the position delta neutral, but the delta-neutral short call options position is not an effective way to hedge an underlying long CNY exposure against further devaluations.
B. The bank will have to sell USD to make the position delta neutral, but the delta-neutral short call options position is not an effective way to hedge an underlying long CNY exposure against further devaluations.
C. The bank will have to buy USD to make the position delta neutral, and the delta-neutral short call options position is an effective way to hedge an underlying long CNY exposure against further devaluations.
D. The bank will have to sell USD to make the position delta neutral, and the delta-neutral short call options position is an effective way to hedge an underlying long CNY exposure against further devaluations.

74. CMM had CNY-denominated loans outstanding to TVR, a manufacturing firm that generated its revenue in CNY. To hedge some of its risk, CMM had bought CDS protection on TVR from a bank from the same country as TVR, Bank EP. If the default probability of TVR and the default correlation between TVR and Bank EP suddenly increased, which of the following is correct?

A. The value of the CDS will increase and CMM has a wrong-way risk with Bank EP.
B. The value of the CDS will decrease and CMM has a wrong-way risk with Bank EP.
C. The value of the CDS will increase and CMM has a right-way risk with Bank EP.
D. The value of the CDS will decrease and CMM has a right-way risk with Bank EP.

75. The risk management group noticed that the liquidity-adjusted VaR that was being reported by the sovereign debt trading desk in Hong Kong was lower than that reported by the sovereign debt trading desk in Singapore, even on identical bond holdings. What could explain this difference in liquidity-adjusted VaR?

A. The Hong Kong desk uses the constant spread approach and the Singapore desk uses the exogenous spread approach.
B. The Hong Kong desk uses the exogenous spread approach and the Singapore desk uses the constant spread approach.
C. Both desks use the endogenous price approach but the Hong Kong desk uses a higher value for the price elasticity of demand assumption.
D. Both desks use the endogenous price approach but the Hong Kong desk uses a higher value for the transaction cost assumption.

76. A CRO at an investment bank has asked the risk department to evaluate the bank's 3-year derivative exposure position with a counterparty. The 1-year CDS on the counterparty is currently trading at a spread of 180 bps. The table below presents trade and forecast data on the CDS spread, the expected exposure, and the recovery rate on the counterparty:

	Year 1	**Year 2**	**Year 3**
Expected exposure (AUD million)	15	15	15
CDS spread (bps)	180	300	420
Recovery rate (%)	85	75	65

Additionally, the CRO has presented the risk team with the following set of assumptions to use in conducting the analysis:

- Counterparty's default probabilities follow a constant hazard rate process
- The investment bank and the counterparty have signed a credit support annex (CSA) to cover this exposure, which requires collateral posting of AUD 13 million over the life of the contract
- The current risk-free rate of interest is 2% and the term structure of interest rates will remain flat over the 3-year horizon
- Collateral and exposure values will remain stable over the life of the contract

Given the information and the assumptions above, what is the correct estimate for the credit valuation adjustment for this position?

A. AUD 0.335 million
B. AUD 0.863 million
C. AUD 1.291 million
D. AUD 2.514 million

77. The CEO of a large bank has reported that the bank's framework for managing operational risk are consistent with Basel II and Basel III model for operational risk governance. Which of the following actions and principles of the bank is correct?

A. The bank considers identification and management of risk as the second line of defense
B. The bank considers independent review and audit of the risk processes and systems as the third line of defense
C. The bank includes damaged reputation due to a failed merger in its measurement of operational risk
D. The bank excludes destruction by fire or other external catastrophes from its measurement of operational risk

78. A risk manager has asked a junior analyst to estimate the implied default probability for a BBB-rated discount corporate bond. Relevant information on other fixed-income securities are given below:

- The Treasury bond (a risk-free bond) yields 4% per year
- The one-year BB-rated discount bond yields 8% per year
- The two-year BB-rated discount bond yields 11% per year

If the recovery rate on a BBB-rated bond is expected to be 0%, and the marginal default probability in year one is 6%, which of the following is the best estimate of the risk-neutral probability that the BBB-rated discount bond defaults within the next 2 years?

A. 6.31%
B. 7.27%
C. 12.22%
D. 13.97%

79. Pension fund managers have to deal with a range of policy, risk, and return requirements. Which of the following statements about risk management in the pension fund industry is correct?

A. A pension plan's total VaR is equal to the sum of its policy-mix VaR and active management VaR.
B. Pension fund risk analysis does not consider performance relative to a benchmark.
C. In most defined-benefit pension plans, if liabilities exceed assets, the shortfall does not create a risk for the plan sponsor.
D. From the plan sponsor's perspective, nominal pension obligations are similar to a short position in a bond.

80. A financial institution has a two-way collateral support annex (CSA) with a counterparty covering a portfolio valued at JPY 400 million. The margining terms of the collateralized portfolio include a threshold of JPY 180 million, a minimum transfer amount of JPY 30 million, and a margin period of risk of 10 days. Which of the following is correct regarding the size of collateral in mitigating the counterparty risk of the portfolio?

A. A lower threshold value is equivalent to a larger portion of exposure protected by collateral.
B. A shorter margin period of risk is equivalent to a smaller portion of exposure protected by collateral.
C. A lower independent amount is equivalent to a larger portion of exposure protected by collateral.
D. The protection from collateral specified in the CSA is uniform throughout the life of the exposure profile.

2017 FRM Part II Practice Exam – Answer Key

1. B
2. B
3. D
4. B
5. C
6. C
7. D
8. B
9. D
10. C
11. D
12. A
13. B
14. C
15. D
16. C
17. D
18. B
19. D
20. C
21. B
22. C
23. A
24. B
25. C
26. C
27. A
28. C
29. B
30. A
31. C
32. C
33. A
34. C
35. B
36. C
37. B
38. B
39. B
40. B
41. C
42. D
43. B
44. D
45. B
46. A
47. B
48. D
49. A
50. B
51. B
52. D
53. A
54. B
55. D
56. B
57. A
58. B
59. B
60. C
61. C
62. A
63. B
64. B
65. B
66. B
67. B
68. D
69. C
70. D
71. C
72. D
73. A
74. B
75. A
76. C
77. B
78. C
79. D
80. A

1. An investment bank with an active position in commodity futures is using the peaks-over-threshold (POT) methodology for estimating VaR and ES. The bank's risk managers have set a threshold level of 3.00% to evaluate excess losses. The choice of the threshold, they argue, is suitable and consistent with the finding that 5.00% of the observations are in excess of the threshold value. The risk managers have concluded that the position's VaR using the POT measure is 4.45% at 99% confidence level. The VaR estimate incorporates the following assumptions generated from the managers' empirical analysis:

Parameter	**Symbol**	**Value**
Loss threshold	u	3%
Number of observations	N	740
Number of observations that exceed threshold	n	37
Scale	β	0.75
Shape (tail index)	ε	0.22

Given the VaR value and the parameter assumptions, which of the following is correct?

A. Increasing the value of the tail index lowers both the ES and the VaR
B. Increasing the loss threshold level increases both the ES and the VaR
C. The value of ES is 4.57%
D. The value of ES is 5.71%

Correct answer: B

Explanation: B is correct (as can be seen from the formula below), increasing u increases both VaR and ES even if n may be lower as u increases.

A is incorrect. Increasing the tail parameter value actually increases both VaR and ES.

C and D are incorrect. According to the peaks-over-threshold (POT) risk measure, the VaR and ES (in percentage) are computed by (note: the first equation is not necessary as the value of VaR is given):

$$VaR = u + \left(\frac{\beta}{\varepsilon}\right)\left\{\left[\frac{N}{n}\left(1 - confidence\ \ level\right)\right]^{-\varepsilon} - 1\right\} = 3 + \left(\frac{0.75}{0.22}\right)\left\{\left[\frac{740}{37}\left(1 - 0.99\right)\right]^{-0.22} - 1\right\} = 4.45\%$$

and, $ES = \frac{VaR}{1-\varepsilon} + \frac{\beta - \varepsilon u}{1-\varepsilon}$

Therefore, $ES = \frac{4.45}{1-0.22} + \frac{0.75 - 0.22 * 3}{1-0.22} = 5.82\%$

The 4.57% is the result when VaR is not scaled by (1 – ε) and is simply added to (β – εu)/(1 – ε). The 5.71% is the result obtained when VaR is divided by (1 – ε) and the second part of the ES value (i.e., (β – εu)/(1 – ε)) is ignored.

Section: Operational and Integrated Risk Management
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 7, Parametric Approaches (II): Extreme Value.
Learning Objective: Describe the peaks-over-threshold (POT) approach.

2. A risk manager is estimating the market risk of a portfolio using both the normal distribution and the lognormal distribution assumptions. The manager gathers the following data on the portfolio:

- Annual mean: 15%
- Annual volatility: 35%
- Current portfolio value: EUR 4,800,000
- Trading days in a year: 252

Which of the following statements is correct?

A. Lognormal 95% VaR is less than normal 95% VaR at the 1-day holding period by 0.13%
B. Lognormal 95% VaR is less than normal 95% VaR at the 1-year holding period by 7.91%
C. Lognormal 99% VaR is less than normal 99% VaR at the 1-day holding period by 1.43%
D. Lognormal 99% VaR is less than normal 99% VaR at the 1-year holding period by 13.86%

Correct answer: B

Explanation:
Annual return = 0.15; Daily return = 0.15/252 = 0.000595
Annual volatility = 0.35; Daily volatility = 0.35/sqrt(252) = 0.022048
The normal VaR and lognormal VaR, in percentage terms, are calculated as follows (ignoring negative signs):
1-day normal 95% VaR = $(R_p – z\sigma)$ = (0.000595 – 1.645 * 0.022048) = 3.57%
1-day lognormal 95% VaR = $(1 – e^{[Rp – z\sigma]})$ = (1 – exp[0.000595 – 1.645*0.022048])m = 3.51%
1-year normal 95% VaR = $(R_p – z\sigma)$ = (0.15 – 1.645 * 0.35) = 42.58%
1-year lognormal 95% VaR = (1 – exp[0.15 – (1.645*0.35)]) = 34.67%
Also,
1-day normal 99% VaR = $(R_p – z\sigma)$ = (0.000595 – 2.326 * 0.022048) = 5.07%
1-day lognormal 99% VaR = $(1 – e^{[Rp – z\sigma]})$ = (1 – exp[0.000595 – 2.326*0.022048]) = 4.94%
1-year normal 99% VaR = $(R_p – z\sigma)$ = (0.15 – 2.326 * 0.35) = 66.41%
1-year lognormal 99% VaR = (1 – exp[0.15 – (2.326*0.35)]) = 48.53%
Hence,
1-day holding period: Lognormal 95% VaR is smaller than Normal 95% VaR by: 3.57 – 3.51 = 0.06%. So, A is incorrect. (See explanation for C below).
1-year holding period: Lognormal 95% VaR is smaller than Normal 95% VaR by: 42.58 – 34.67 = 7.91%. So, B is correct.
1-day holding period: Lognormal 99% VaR is smaller than Normal 99% VaR by: 5.07 – 4.94 = 0.13%. So, C is incorrect (4.94 – 3.51 = 1.43%).
1-year holding period: Lognormal 99% VaR is smaller than Normal 99% VaR by: 66.41 – 48.53 = 17.88%. So, D is incorrect (48.53 – 34.67 = 13.86%).
The normal VaR and lognormal VaR, in value terms, are calculated as follows (ignoring negative signs):
1-day normal 95% VaR = $(R_p – z\sigma)*V$ = (0.000595 – 1.645 * 0.022048)*4.8m = EUR 171,235
1-day lognormal 95% VaR = $(1 – e^{[Rp – z\sigma]})*V$ = (1 – exp[0.000595 – 1.645*0.022048])*4.8m = EUR 168,217
1-year normal 95% VaR = $(R_p – z\sigma)*V$ = (0.15 – 1.645 * 0.35)*4.8m = EUR 2,043,600
1-year lognormal 95% VaR = (1 – exp[0.15 – (1.645*0.35)])*4.8m = EUR 1,664,258
Also,
1-day normal 99% VaR = $(R_p – z\sigma)*V$ = (0.000595 – 2.326 * 0.022048)*4.8m = EUR 243,306
1-day lognormal 99% VaR = $(1 – e^{[Rp – z\sigma]})*V$ = (1 – exp[0.000595 – 2.326*0.022048])*4.8m = EUR 237,242

1-year normal 99% VaR = $(R_p - z\sigma)*V$ = (0.15 – 2.326 * 0.35)*4.8m = EUR 3,187,680
1-year lognormal 99% VaR = (1 – exp[0.15 – (2.326*0.35)])*4.8m = EUR 2,329,264
Hence,
1-day holding period: Lognormal 95% VaR is smaller than Normal 95% VaR by: 171,235 – 168,217 = EUR 3,018.
1-year holding period: Lognormal 95% VaR is smaller than Normal 95% VaR by: 2,043,600 – 1,664,258 = EUR 379,342.
1-day holding period: Lognormal 99% VaR is smaller than Normal 99% VaR by: 243,306 – 237,242 = EUR 6,064.
1-year holding period: Lognormal 99% VaR is smaller than Normal 99% VaR by: 3,187,680 – 2,329,264 = EUR 858,416.

Section: Market Risk Measurement and Management
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 3, Estimating Market Risk Measures: An Introduction and Overview.
Learning Objective: Estimate VaR using a parametric approach for both normal and lognormal return distributions.

3. A risk team at an investment bank uses the KMV model to estimate the distance to default and expected default frequency in evaluating default conditions of both potential and existing client firms. One such client currently has total assets valued at USD 20 billion, asset volatility of 28% per annum, short-term debt of USD 7 billion, and long-term debt of USD 6 billion. The expected return on the firm's assets is 5% per year and the risk free rate is 1% per year. The firm does not pay any dividends. The rating schedule at a 1-year horizon is shown in the table below:

Expected Default Frequency (EDF)	Rating Class
0.02% – 0.04%	AAA
0.04% – 0.10%	AA/A
0.10% – 0.19%	A/BBB+
0.19% – 0.40%	BBB+/BBB-
0.40% – 0.72%	BBB-/BB
0.72% – 1.01%	BB/BB-

What is the suggested credit rating of the firm at a 1-year horizon using the rating schedule provided?

A. AA/A
B. A/BBB+
C. BBB+/BBB-
D. BBB-/BB

Correct answer: D

Explanation: D is the correct answer. Using the KMV model, default value of debt = Short-term + 0.5*Long-term debt. And, according to the Merton Model, the probability of default at a one-year horizon = N(-DD), where DD is the distance to default and:

$$DD = \frac{\left(\log(V) - \log(X) + \left(\mu - \sigma_v^2 / 2\right)(T - t)\right)}{\sigma_v \sqrt{T - t}} = 2.5$$

where V = 20; X = 7 + 6/2 = 10; σ = 0.28; μ = 0.05; T-t = 1. And so,

PD = N(-2.5141) = N(-2.5) = 0.62

Section: Credit Risk Measurement and Management
Reference: Rene Stulz, Risk Management & Derivatives (Florence, KY: Thomson South-Western, 2002). Chapter 18, Credit Risks and Credit Derivatives.
Learning Objective: Using the Merton model, calculate the value of a firm's debt and equity and the volatility of firm value.

4. A risk manager is comparing the use of parametric and non-parametric approaches for calculating VaR and is concerned about some of the characteristics present in the loss data. Which of the following conditions would make non-parametric approaches the favored method to use?

A. Scarcity of high magnitude loss event
B. Skewness in the distribution
C. Unusually high volatility during the data period
D. Unusually low volatility during the data period

Correct answer: B

Explanation: B is correct. Non-parametric approaches can accommodate fat tails, skewness, and any other non-normal features that can cause problems for parametric approaches.

However, if the data period that is used in estimation includes few losses or losses with low magnitude, non-parametric methods will often produce risk measures that are too low. Specifically, non-parametric approaches produce VaR and ES that are too low if the data period has unusually low volatility, and would produce VaR and ES that are too high if the data period has unusually high volatility. Hence parametric methods would be more appropriate in those situations. Therefore, A, C and D are incorrect.

Section: Market Risk Measurement and Management
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 4, Non-parametric Approaches.
Learning Objective: Identify advantages and disadvantages of non-parametric estimation methods.

5. LMT Bank has entered into a 1-year CDS contract with an endowment fund. According to the contract, LMT Bank will pay the endowment fund 75% of the face value of a bond issued by GTE Chemical Corporation immediately after a default by GTE Chemical. To purchase this CDS, the endowment fund will pay LMT Bank the CDS spread, which is a percentage of the face value, once at the end of the year. LMT Bank estimates that the risk-neutral default probability for GTE Chemical is 6% per year. The risk-free rate is 3% per year. Assuming defaults can only occur halfway through the year and that the accrued premium is paid immediately after a default, what is the estimate for the CDS spread?

A. 457 basis points
B. 468 basis points
C. 471 basis points
D. 628 basis points

Correct answer: C

Explanation: The key to CDS valuation is to equate the present value (PV) of payments to the PV of expected payoff in the event of default. Let:
r = risk-free rate = 3%
s = CDS spread.
π = probability of default during year 1 = 6%
C = contingent payment in case of default = 75%
$d_{0.5}$ =discount factor for half-year = $e^{-0.5*r} = e^{-0.5*0.03} = 0.985112$
$d_{1.0}$ =discount factor for 1-year = $e^{-1.0*r} = e^{-0.03} = 0.970446$

Therefore, to solve for the CDS spread (s):
The PV of payments (premium leg, which includes the spread payment and accrual) is:
$s*[0.5*d_{0.5}*\pi + d_{1.0}*(1-\pi)] = s*[0.029553 + 0.912219] = s*0.941772$

The payoff leg (in the event of default) = $C*d_{0.5}*\pi = 0.75*0.985112*0.06 = 0.044330$
Equating the two PVs and solving for the spread: $s*0.941772 = 0.044330$
Thus, s = 0.047071 or a spread of approximately 471 basis points.

A is incorrect. It considers coupon payment at year-end and not at half-year.
B is incorrect. It ignores the half-year coupon payment on the premium leg.
D is incorrect. It uses a contingent payment in case of default of 100% instead of 75%.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Compare the different ways of representing credit spreads.

6. A risk analyst at a mid-size hedge fund is evaluating the credit risk of several trade positions. The hedge fund specializes in corporate debt and runs a strategy that utilizes both relative value and long-only trades using CDS and bonds. One of the new trades at the hedge fund is a BBB-rated long bond valued at JPY 10 billion. Some of the hedge fund's newest clients, including the BBB-rate bond holders, are restricted from withdrawing their funds for four years. The analyst is currently evaluating the impact of various default scenarios to estimate future asset liquidity. The analyst has estimated that the marginal probability of default of the BBB-rated bond is 5% in Year 1, 8% in Year 2, 15% in Year 3, and 24% in Year 4. What is the probability that the bond makes coupon payments for 4 years and then defaults at the end of Year 4?

A. 7.6%
B. 13.1%
C. 17.8%
D. 20.4%

Correct answer: C

Explanation: C is correct. The probability that the bond defaults in Year 4 can be modeled as a Bernoulli trial given by the following equation, where MP stands for marginal probability:

P (Default at end of Year 4) = (1 – MP Year 1 default)*(1 – MP Year 2 default) * (1 – MP Year 3 default)* (MP Year 4 default) = (1 – 0.05)*(1 – 0.08)*(1 – 0.15)*(0.24) = 0.1783 = 17.83% = 17.8%.

A is incorrect. It is the probability that the bond defaults in Year 2.
B is incorrect. It is the probability that the bond defaults in Year 3.
D is incorrect. It incorrectly computes the probability of default in Year 4 as: (1 – 0.15)*0.24 = 20.4%.

Section: Credit Risk Measurement and Management
References: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Explain how default risk for a single company can be modeled as a Bernoulli trial.

7. MDM Bank is seeking to enhance its enterprise risk management function. In order to achieve that objective the bank introduces a new decision-making process based on economic capital that involves assessing sources of risk across different business units and organizational levels. Which of the following statements regarding the correlations between these risks is correct?

A. Correlations between business units are only relevant in deciding total firm-wide economic capital levels and are not relevant for decisions at the individual business unit or project level.
B. Correlations between broad risk types such as credit, market, and operational risk are generally well understood and are easy to estimate at the individual firm level.
C. The introduction of correlations into firm-wide risk evaluation will result in a total VaR that, in general, is greater than or equal to the sum of individual business unit VaRs.
D. The introduction of correlations into the risk evaluation of a bank's loan book will result in total credit VaR that, in general, is less than or equal to the sum of individual loan credit VaRs.

Correct answer: D

Explanation: D is correct. Credit VaR (CVaR)= VaR – EL. Lower (or negative) correlations among loan assets lead to lower overall VaR due to the diversification effect, which effectively lowers CVaR since EL is not affected by correlations. When correlations are perfectly positive (and equal to one), there is no diversification and loan portfolio VaR will equal the sum of the individual loan VaRs. Choices a, b and c are incorrect.

Section: Operational and Integrated Risk Management
Reference: Brian Nocco and René Stulz, "Enterprise Risk Management: Theory and Practice," Journal of Applied Corporate Finance 18, No. 4 (2006): pp. 8-20.
Learning Objective: Describe the role of and issues with correlation in risk aggregation, and describe typical properties of a firm's market risk, credit risk, and operational risk distributions.

8. A pension fund has reported that its assets and liabilities were valued at USD 840 million and USD 450 million, respectively, at year-end 2015. The assets were fully invested in equities and commodities. The fund's liabilities, constituted entirely by fixed-income obligations, had a modified duration of 12 years. In 2016, the global slump in commodity prices affected the pension fund assets, specifically causing its investment in equities and commodities to lose 30% of their market value. However, the surprising monetary policy action of the government that led to the increase in interest rates had a positive effect on the performance of fixed-income securities, causing yields on the fund's liabilities to rise by 2.3%. What was the change in the pension fund's surplus in 2016?

A. USD -325.8 million
B. USD -127.8 million
C. USD 262.2 million
D. USD 390.0 million

Correct answer: B

Explanation: B is correct. The change in the pension fund's surplus (ΔS) for the year 2016 is equal to the ending surplus (S_1) at the end of 2016 less the initial surplus (S_0) at the end of 2015. That is, $\Delta S = S_1 - S_0$.

The initial surplus is calculated as $S_0 = A_0 - L_0 = 840 - 450 =$ USD 390 million, where A_0 = the firm's initial assets and L_0 = the firm's initial liabilities.

Next we have to calculate S_1, the surplus at the end of 2016. Given the 30% decline in the equity and commodity markets, the new level of assets A_1 at the end of 2016 is equal to:
$A_1 = (1 - 0.3) * 840 =$ USD 588 million.

Since the percentage change in liability value = $- D_M * \Delta y$, where DM = modified duration = 12; and Δy = change in yield = +2.3%, then the new level of liabilities L_1 at the end of 2016 can be calculated as:
$L_1 = [1 - (D_M * \Delta y)] * L_0 = [1 - 12*(+0.023)] * 450 =$ USD 325.8 million

Thus, the ending surplus for 2016 = $S_1 = A_1 - L_1 = 588 - 325.8 =$ USD 262.2 million

Therefore the change in surplus for 2016 = $\Delta S = S_1 - S_0 = 262.2 - 390 =$ USD –127.8 million (which implies the pension fund is actually in a deficit situation at the end of 2016).
A is incorrect. USD -325.8 million is the negative amount of liabilities at year-end 2016.
C is incorrect. USD 262.8 million is the year-end 2016 surplus.
D is incorrect. USD 390.0 million is the year-end 2015 surplus.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Describe the investment process of large investors such as pension funds.

9. A wealth management firm has a portfolio consisting of USD 48 million invested in US equities and USD 35 million invested in emerging markets equities. The 1-day 95% VaR for each individual position is USD 1.2 million. The correlation between the returns of the U.S. equities and emerging markets equities is 0.36. While rebalancing the portfolio, the manager in charge decides to sell USD 8 million of the US equities to buy USD 8 million of the emerging markets equities. At the same time, the CRO of the firm advises the portfolio manager to change the risk measure from 1-day 95% VaR to 10-day 99% VaR. Assuming that returns are normally distributed and that the rebalancing does not affect the volatility of the individual equity positions, by how much will the portfolio VaR increase due to the combined effect of portfolio rebalancing and change in risk measure?

A. USD 6.870 million
B. USD 8.248 million
C. USD 11.270 million
D. USD 12.482 million

Correct answer: D

Explanation: D is correct. The first step is to calculate the VaR of the original portfolio of two equities, U.S. (u) and emerging markets (e). This can be derived by using the following equation:

$$VaR_p = \sqrt{\left(VaR_u^2 + VaR_e^2 + 2 * \rho_{ue} * VaR_u * VaR_e\right)}$$

where ρ_{PA} is the correlation coefficient.

(i) Initial position: The portfolio 1-day 95% VaR (before the rebalancing) is therefore:

$$VaR_p = \sqrt{\left(1.2^2 + 1.2^2 + 2 * 0.36 * 1.2 * 1.2\right)} = USD\ 1.97918\, million = USD\ 1.979\, million$$

(ii) Rebalanced position: 1-day 95% VaR: After the rebalance, the market value of the position in the U.S. equities is reduced by 8/48 = 0.1667, so VaR_u is now equal to (1 - 0.1667)*(USD 1.2 million) = USD 1.0 million. Meanwhile the market value for the position in the emerging market equities has increased by 8/35 = 0.2286 so that VaR_A is now (1 + 0.2286)* (USD 1.2 million) = USD 1.474 million. Hence the 1-day 95% VaR of the new portfolio (after rebalancing) = USD 3.234 million and is calculated as follows:

$$VaR_p = \sqrt{\left(1.474^2 + 1.0^2 + 2 * 0.36 * 1.474 * 1.0\right)} = USD\ 3.234\, m = USD\ \ 3.234\, million$$

(iii) Next, convert the 1-day 95% VaR to 10-day 95% VaR:
10-day 95% VaR = (1-day 95% VaR) * sqrt(10)/1 = 3.234 x 3.162278 = USD 10.227 million.

(iv) Finally, convert the 10-day 95% VaR to 10-day 99% VaR:
10-day 99% VaR = (10-day 95% VaR) * (2.326/1.645) = 10.227 x 1.4140 = USD 14.461 million.

Therefore, the question is to compare the original 1-day 95% VaR (USD 1.979m) to the new rebalanced 10-day 99% VaR (USD 14.461). Thus, VaR will increase by (14.461 – 1.979) million, or USD 12.482 million.

A is incorrect. USD 6.870 million is the increase in portfolio VaR if the 1-day 95% unrebalanced portfolio VaR is converted to a 10-day 99% VaR.
B is incorrect. USD 8.249 million is the difference between the 10-day 95% VaR for the rebalanced portfolio and the 1-day 95% VaR for the unrebalanced portfolio.
C is incorrect. USD 11.270 million is the difference between the 10-day 99% VaR for the rebalanced portfolio and the 1-day 95% VaR for the rebalanced portfolio.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 7: Portfolio Risk — Analytical Methods.
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

10. The board of directors at Bank PQP is evaluating a proposal by senior management to restructure the operations of the bank. Of key concern is the future of the bank's consumer lending division, which has a loan portfolio amounting to EUR 180 million. The bank funds the division predominantly using unstable retail and wholesale deposits. In analyzing the credit risk condition of the division, management determines that the probability of default is 8%, the loss given default is 70%, and the exposure at default is 100% of the loan exposure. The CEO is arguing that the risk capital that has been set aside to support consumer lending, in line with the bank's stated risk appetite, is too high compared to the performance of the other business divisions. The bank applies the same hurdle rate and effective tax rate across all business lines, and a 1-year horizon to measure parameters whose values are shown in the table below:

Item	**Value**
Consumer Lending Division:	
Economic capital	EUR 135.0 million
Return on the loan portfolio	14.0%
Return on risk capital	3.0%
Cost of debt capital	6.0%
Operating direct costs	EUR 1.595 million
Transfers	EUR 0.0 million
Bank PQP:	
Hurdle rate	8.0%
Equity market return	7.0%
Risk-free rate	3.0%
Equity beta	1.05
Effective tax rate	32.0%

Assuming earnings correlations between the various divisions are the same and the main objective of each division is to add value for the bank's shareholders, which of the following recommendations of the board is correct?

A. Close down the consumer lending division because the adjusted RAROC is less than the risk-free rate
B. Close down the consumer lending division because RAROC is less than the hurdle rate
C. Keep the consumer lending division because the adjusted RAROC is greater than the risk-free rate
D. Keep the consumer lending division because RAROC is greater than the hurdle rate

Correct answer: C

Explanation:

$$RAROC = \frac{Expected\ return}{Economic\ capital} = \frac{ER - IC - OC - EL - Taxes + RORC \pm Transfers}{Economic\ capital} = 0.079993 = 8.0\%$$

where:

ER = Expected revenue = 0.14 x 180,000,000 = EUR 25.2 million
IC = Interest costs = 0.04 x 180,000,000 = EUR 7.2 million
OC = Operating costs = EUR 1.595 million
EL = Expected losses = PD x LGD x EAD = 0.06 x 0.6 x 1.0*180 million = EUR 6.48 million
Taxes = (25.2 – 7.2 – 1.595 – 6.48)*(0.32) = EUR 3.176 million
RORC = Return on risk capital = 0.03*135,000,000 = EUR 4.05 million
Transfers = 0

$$Adjusted\ \ RAROC = RAROC - \beta * \left(R_m - r_f\right) = 7.9993 - 1.05 * (7 - 3) = 3.7993 = 3.8\%$$

Therefore, adjusted RAROC is greater than the risk-free rate, so the correct decision is to keep (accept) the consumer lending division as it can add value to the bank's shareholders, on a risk-adjusted basis. RAROC and the hurdle rate are about the same and, using the criterion, the board would be indifferent.

Section: Operational and Integrated Risk Management
Reference: Michel Crouhy, Dan Galai and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 17, Risk Capital Attribution and Risk-Adjusted Performance Measurement.
Learning Objective: Compute and interpret the RAROC for project, loan or loan portfolio, and use RAROC to compare business unit performance; Compute the adjusted RAROC for a project to determine its viability.

11. A credit manager who is well versed in lessons learned from the 2007–2009 subprime mortgage crisis in the US is overseeing the structured credit book of a bank in order to identify potential frictions in the securitization process. Which of the following is a correct combination of a potential friction in the securitization process and an appropriate mechanism to mitigate that friction?

A. Friction between the asset manager and the investor: Adverse selection problem. This problem can be mitigated by the asset manager charging due diligence fees to the investor.
B. Friction between the arranger and the originator: Model error problem. This problem can be mitigated by the arranger providing a credit enhancement to the securities with its own funding.
C. Friction between the investor and credit rating agencies: Principal-agent conflict. This problem can be mitigated by requiring credit rating agencies to be paid by originators and not by investors for their rating services.
D. Friction between the servicer and the mortgagor: Moral hazard problem. This problem can be mitigated by requiring the mortgagor to escrow funds for insurance and tax payments in order to forestall the risk of foreclosure.

Correct answer: D

Explanation: D is correct. The friction between the servicer and the mortgagor is a moral hazard problem. The servicer and the mortgagor do not share the full consequence of bad outcomes (e.g., loan foreclosure, delinquencies). The mortgagor typically has limited liability, and has little incentive to expend effort or resources to maintain a property close to foreclosure. On the other hand, the servicer strives to work in investors' best interest by keeping up with payment of property taxes and insurance, and generally maintaining the property. A way to mitigate this friction is to require the mortgagor to regularly escrow funds for insurance and tax payments in order to forestall the risk of foreclosure.

A is incorrect. Friction between the asset manager and the investor is a principal-agent problem. The investor is less sophisticated than the asset manager, does not fully understand the investment strategy of the asset manager, has uncertainty about the manager's ability, and does not observe any effort that the manager makes to conduct due diligence. Some of the ways to mitigate this friction is through the use of investment mandate, and the evaluation of manager performance relative to its peers or a peer benchmark.

B is incorrect. Friction between the arranger and originator is an adverse selection problem. It is one of the key frictions in the process of securitization involving an information problem between the originator and arranger. In particular, the originator has an information advantage over the arranger with regard to the quality of the borrower. Without adequate safeguards in place, an originator can have the incentive to collaborate with a borrower in order to make significant misrepresentations on the loan application. Depending on the situation, this could be either construed as predatory lending (where the lender convinces the borrower to borrow too large of a sum given the borrower's financial situation) or predatory borrowing (the borrower convinces the lender to lend too large a sum). To mitigate the problem, the arranger should have safeguards in place, including carrying out a thorough due diligence on the originator and requiring the originator to have adequate capital to buy back problem loans.

C is incorrect. Friction between the investor and credit rating agencies is a model error problem. Investors are not able to assess the efficacy of rating agency models and, so, are susceptible to both honest and dishonest errors. Worse still, rating agencies are paid by the arranger and not by the investors for their opinion, which creates potential conflict of interest. This friction can be mitigated by requiring public disclosure of the criteria for ratings and downgrades, and for holding rating agencies accountable for their reputation.

Section: Credit Risk Measurement and Management
Reference: Adam Ashcroft and and Til Schuermann, “Understanding the Securitization of Subprime Mortgage Credit,” Federal Bank of New York Staff Reports, No. 318 (March 2008).
Learning Objective: Identify and describe key frictions in subprime mortgage securitization, and assess the relative contribution of each factor to the subprime mortgage problems.

12. A risk manager is backtesting a company’s 1-day 99.5% VaR model over a 1-year horizon at a 95% confidence level. Assuming 250 days in a year, what is the maximum number of daily losses exceeding the 1-day 99.5% VaR that is acceptable to conclude that the model is calibrated correctly?

A. 3
B. 5
C. 15
D. 19

Correct answer: A

Explanation: The risk manager will reject the hypothesis that the model is correctly calibrated if the number x of losses exceeding the VaR is such that:

$$\frac{x - pT}{\sqrt{p(1-p)T}} > z = 1.96$$

where p represents the failure rate and is equal to 1-0.995, or 0.5%; and T is the number of observations = 250. And z = 1.96 is the two-tail confidence level quantile. If

$$\frac{x - 0.005 * 250}{\sqrt{0.005 * (1 - 0.005) * 250}} = 1.96$$

then, x = 3.436. So the maximum number of exceedances would be 3 to conclude that the model is calibrated correctly.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 6, Backtesting VaR.
Learning Objective: Verify a model based on exceptions or failure rates.

13. A portfolio manager is mapping a fixed-income portfolio into exposures on selected risk factors. The manager is analyzing the comparable mechanics and risk measurement outputs of principal mapping, duration mapping, and cash-flow mapping that correspond to the average portfolio maturity. Which of the following is correct?

A. Principal mapping considers coupon and principal payments, and the portfolio VaR using principal mapping is greater than the portfolio VaR using cash-flow mapping.
B. Duration mapping does not consider intermediate cash flows and the portfolio VaR using duration mapping is less than the portfolio VaR using principal mapping.
C. Cash-flow mapping considers the timing of the redemption cash flow payments only, and the portfolio VaR using cash flow mapping is less than the portfolio VaR using duration mapping.
D. Cash-flow mapping considers the present values of cash flows grouped into maturity buckets, and the undiversified portfolio VaR using cash-flow mapping is greater than the portfolio VaR using principal mapping.

Correct answer: B

Explanation: B is correct. With duration mapping, a portfolio is replaced by a zero-coupon bond with maturity equal to the duration of the portfolio. The risk of the hypothetical zeros is less than the risk of a coupon bond of comparable maturity. Therefore, the portfolio VaR using duration mapping is less than the portfolio VaR using principal mapping.

With principal mapping, one risk factor is chosen that corresponds to the average portfolio maturity. With duration mapping, one risk factor is chosen that corresponds to the portfolio duration. With cash flow mapping, the portfolio cash flows are grouped into maturity buckets and the undiversified portfolio VaR using cash-flow mapping is less than the portfolio VaR using principal mapping since principal mapping ignores the intervening coupon payments, thus overstating the true risk of the portfolio.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 11, VaR Mapping.
Learning Objective: Differentiate among the three methods of mapping portfolios of fixed income securities.

14. A CRO of a hedge fund is asking the risk team to develop a term-structure model that is appropriate for fitting interest rates for use in the fund’s options pricing practice. The risk team is evaluating among several interest rate models with time-dependent drift and time-dependent volatility functions. Which of the following is a correct description of the specified model?

- **A.** In the Ho-Lee model, the drift of the interest rate process is presumed to be constant.
- **B.** In the Ho-Lee model, when the short-term rate is above its long-run equilibrium value, the drift is presumed to be negative.
- **C.** In the Cox-Ingersoll-Ross model, the basis-point volatility of the short-term rate is presumed to be proportional to the square root of the rate, and short-term rates cannot be negative.
- **D.** In the Cox-Ingersoll-Ross model, the volatility of the short-term rate is presumed to decline exponentially to a constant level.

Correct answer: C

Explanation: C is correct. In the CIR model, the basis-point volatility of the short rate is not independent of the short rate as other simpler models assume. The annualized basis-point volatility equals σ*sqrt(r) and therefore increases as a function of the square root of the rate. Short-term rate in the CIR model cannot become negative because of the combined property that (i) basis-point volatility equals zero when short-term rate is zero, and (ii) the drift is positive when the short-term rate is zero.

Section: Market Risk Measurement and Management
Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9: The Art of Term Structure Models: Drift
Learning Objectives: Describe methods of addressing the possibility of negative short-term rates in term structure models; Construct a short-term rate tree under the Ho-Lee Model with time-dependent drift.
Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 10: The Art of Term Structure Models: Volatility and Distribution.
Learning Objective: Describe the short-term rate process under the Cox-Ingersoll-Ross (CIR) and lognormal models.

15. A portfolio strategist for a hedge fund is looking to mitigate counterparty credit risk exposure to LLG, an A-rated firm. Currently the hedge fund has the following derivative contracts with firm LLG:

Contract	Contract Value (SGD)
X	20,000,000
Y	40,000,000
Z	16,000,000
W	1,500,000

With the information provided, what is the most appropriate credit risk mitigation technique that the hedge fund should use in this case?

A. Implement a netting scheme.
B. Use credit triggers.
C. Sell credit default swaps on LLG.
D. Increase collateral.

Correct answer: D

Explanation: Increasing collateral would effectively reduce current credit exposure depending on the contract parameters, mainly minimum transfer amount and threshold.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets (West Sussex, UK: John Wiley & Sons, 2012). Chapter 3, Defining Counterparty Credit Risk.
Learning Objective: Identify and describe the different ways institutions can manage and mitigate counterparty risk.

16. A mid-sized investment bank conducts several trades. As part of its risk control, it has entered into netting agreements on 8 equity trade positions with an average correlation of 0.28. The firm believes that it can improve upon the diversification benefit of netting by a judicious choice of number of exposures with a favorable correlation coefficient. Which of the following trade combinations would increase the firm's expected netting benefit the most from the current level?

Trade Combination	Number of Positions	Average Correlation
ABC	4	0.25
LMN	7	0.15
PQR	13	–0.06
TUV	15	–0.04

A. Trade combination ABC
B. Trade combination LMN
C. Trade combination PQR
D. Trade combination TUV

Correct answer: C

Explanation: Trade combination c is the correct answer. Netting factor is expressed as:

$$Netting\ \ factor = \frac{\sqrt{n + n(n-1)\rho}}{n}$$

For the current position, when *n* (number of positions) = 8 and ρ (correlation coefficient) = 0.28,

$$Netting\ \ factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{8 + 8 * (8-1)(0.28)}}{8} = 60.83\%$$

c is correct. When *n* = 13 and ρ = -0.06, there is the most reduction in netting factor,

$$Netting\ \ factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{13 + 13 * (13-1)(-0.06)}}{13} = 14.68\%$$

a is incorrect. When *n* = 4 and ρ = 0.25, there is only a modest netting benefit:

$$Netting\ \ factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{4 + 4 * (4-1)(0.25)}}{5} = 66.14\%$$

b is incorrect. When *n* = 7 and ρ = 0.15, there is reduction in netting factor but not as much as in c,

$$Netting\ \ factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{7 + 7 * (7-1)(0.15)}}{7} = 52.10\%$$

d is incorrect. When $n = 15$ and $\rho = -0.04$, there is a reasonable reduction in netting factor but not as much as in c,

$$Netting\ \ factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{15 + 15 * (15-1)(-0.04)}}{15} = 17.13\%$$

Section: Credit Risk Measurement and Management
Reference: Jon Gregory (2012), Counterparty Credit Risk: A Continuation Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons). Chapter 8, Credit Exposure.
Learning Objective: Explain the impact of netting on exposure, the benefit of correlation, and calculate the netting factor.

17. A portfolio manager is interested in acquiring Stock GIL as part of an existing portfolio. However, the manager is concerned about the level of liquidity risk and proceeds to estimate liquidity adjusted VaR for the stock. The manager observes a quote for Stock GIL and reports that the midpoint of its current best bid and best ask prices is AUD 66. Stock GIL has an estimated daily return volatility of 0.27% and average bid-ask spread of AUD 0.18. Using the constant spread approach on a 30,000 share position and assuming the returns of Stock GIL are normally distributed, what is the correct estimate for the stock's liquidity-adjusted 1-day 99% VaR?

A. AUD 2,700
B. AUD 5,400
C. AUD 12,400
D. AUD 15,100

Correct answer: D

Explanation: The daily 99% VaR = 66 *30,000 * (2.326 * 0.0027) = AUD 12,434.80

The constant spread approach adds half of the bid-ask spread (as a percent) to the VaR calculation, using the following formula:

Liquidity Cost (LC) = ½*(Spread * P),

where Spread is equal to the actual spread divided by the midpoint and P is the value of the position.

Therefore the liquidity cost (LC) = 0.5 * (0.18/66)* 66*30,000 = AUD 2,700; and

Liquidity-adjusted VaR (LVaR) = VaR + LC = 12,434.80 + 2,700 = AUD 15,134.80

Section: Operational and Integrated Risk Management
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 14, Estimating Liquidity Risks.
Learning Objective: Describe and calculate LVaR using the constant spread approach and the exogenous spread approach.

18. A manager is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at CNY 136 million and contains CNY 12 million in stock Y. The standard deviation of returns of stock Y is 18% annually and that of the overall portfolio is 23% annually. The correlation of returns between stock Y and the portfolio is 0.42. Assuming the risk analyst uses a 1-year 95% VaR and that returns are normally distributed, how much is the component VaR of stock Y?

A. CNY 0.817 million
B. CNY 1.492 million
C. CNY 2.110 million
D. CNY 3.553 million

Correct answer: B

Explanation: The component VaR for stock Y ($cVaR_Y$) can be presented as:

$$cVaR_Y = \rho_{Y,p} * VaR_Y$$

where VaR = VaR of stock Y; and $\rho_{Y,p}$ = correlation coefficient between stock Y and the portfolio.

Let w_Y represent the value of stock Y; σ_Y represent the standard deviation of stock Y returns; α(95%) represent the 95% confidence factor for the VaR estimate, which is 1.645. Hence,

$VaR_Y = w_Y * \sigma_Y * \alpha(95\%)$ = CNY 12 million x 0.18 x 1.645 = CNY 3.553 million.

Therefore,

$cVaR_Y = \rho_{Y,p} * VaR_Y$ = 0.42 x 3.553 = CNY 1.492 million

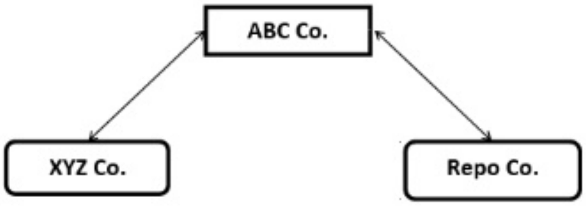
Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 7, Portfolio Risk: Analytical Methods.
Learning objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

QUESTIONS 19 AND 20 REFER TO THE FOLLOWING INFORMATION

XYZ, a small investment management firm, specializes in structuring small business loans and selling the government guaranteed portion to other institutional investors while retaining the riskier portions for high net worth investors. XYZ funds its operations by engaging in overnight repurchase agreements (repos) with three firms, but primarily with ABC, a firm that specializes in pooling funds from community banks and local government agencies and investing them in short-term, high-quality, government-secured investments.

Last week, XYZ was informed by ABC that its line had been frozen. XYZ learned that ABC had been defrauded by Repo Co., another repo borrower, who had provided false documentation of non-existent collateral of government-guaranteed loans. ABC feared a run by its investors as news of the fraud spread.

The diagram below illustrates the parties involved:



19. The use of a central clearinghouse to handle the transactions executed between XYZ's main funding source, ABC and ABC's client, Repo Co., would likely have resulted in a reduction in:

- **A.** ABC's funding liquidity risk.
- **B.** Repo Co.'s default risk.
- **C.** XYZ's lending risk.
- **D.** ABC's operational risk.

Correct answer: D

Explanation: If it uses a clearinghouse and the clearinghouse makes a mistake (operational risk) like that made by ABC, ABC will have recourse to the clearinghouse and it would have, therefore, reduced its operational risk exposure.
A. Incorrect. ABC is not funding from Repo Co.
B. Incorrect. The use of a clearinghouse does not change Repo Co.'s default risk – just ABC's exposure to Repo Co. defaults.
C. Incorrect. The use of a clearinghouse in this situation does not reduce XYZ's lending risk.

Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 3 – Defining Counterparty Credit Risk
Learning Objective: Describe counterparty risk and differentiate it from lending risk.

20. By using a clearinghouse to handle the repo transactions between ABC and Repo Co., obligations owed between the two could have been netted once the fraudulent documentation was discovered. Which of the following is the most appropriate type of netting to use in this situation and what would be a likely additional impact from using this netting?

A. Payment netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
B. Payment netting would be used, which would reduce Repo Co.'s counterparty risk, but ABC's counterparty risk would be increased.
C. Closeout netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
D. Closeout netting would be used, which would reduce Repo Co.'s counterparty risk, but ABC's counterparty risk would be increased.

Correct answer: C

Explanation:
Payment netting per the reading is the simple netting of cash flows due on the same day. Closeout netting occurs if there is an event of default, which would include an incidence of fraud. One of the shortcomings of clearinghouses, and closeout netting as well, is that the other party, in this case ABC Bank, jumps to the head of the queue with its claim on Repo Co. to the possible detriment of others, particularly those outside the clearinghouse in general.

Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 4 – Netting, Compression, Resets, and Termination Features
Learning Objective: Summarize netting and close-out procedures (including multilateral netting), explain their advantages and disadvantages, and describe how they fit into the framework of the ISDA master agreement.

21. A risk analyst at a fund management company is discussing with the risk team the gaps in the company's risk measurement system. Among the issues they have identified is the understanding that failing to anticipate cash flow needs is one of the most serious errors that a firm can make. Addressing such a problem demands that a good liquidity-at-risk (LaR) measurement system be an essential part of the bank's risk management framework. Which of the following statements concerning LaR is correct?

A. A firm's LaR tends to decrease as its credit quality declines.
B. For a hedged portfolio, the LaR can differ significantly from the VaR.
C. Hedging using futures has the same impact on LaR as hedging using long option positions.
D. Reducing the basis risk through hedging decreases LaR.

Correct answer: B

Explanation: The LaR can differ substantially from the VaR in a hedged portfolio, and in different situations can be larger or smaller than the VaR. For example, consider a portfolio where futures contracts are used to hedge. While the hedge can reduce the VaR of the portfolio, the LaR can be larger than the VaR as the futures contracts create an exposure to margin calls and the potential for cash outflows. Alternatively, in situations where the hedging instruments do not result in potential cash outflows over the measurement period (e.g. a portfolio of European options which do not expire during the period), the LaR can be smaller than the VaR.

Section: Operational and Integrated Risk Management
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 14, Estimating Liquidity Risks.
Learning Objective: Describe liquidity at risk (LaR) and compare it to VaR, describe the factors that affect future cash flows, and explain challenges in estimating and modeling LaR.

22. Pillar 1 of the Basel II framework allows banks to use various approaches to calculate the capital requirements for credit risk, operational risk, and market risk. Which of the following Basel II approaches allows a bank to explicitly recognize diversification benefits?

A. The basic indicator approach for operational risk
B. The internal ratings based approach for credit risk
C. The internal models approach for market risk
D. The standardized approach for operational risk

Correct answer: C

Explanation: The internal models approach allows banks to use risk measures derived from their own internal risk management models, subject to a set of qualitative conditions and quantitative standards. In terms of risk aggregation within market risk, banks are explicitly allowed to recognize empirical correlations across broad market risk categories, and, thus, diversification benefits.

Section: Operational and Integrated Risk Management
Reference: John Hull, Risk Management and Financial Institutions, 4th Edition, (New York: John Wiley & Sons, 2015). Chapter 15, Basel I, Basel II, and Solvency II.
Learning Objective: Describe and contrast the major elements—including a description of the risks covered—of the two options available for the calculation of market risk: Standardized Measurement Method and Internal Models Approach.

23. The risk audit committee of a mutual fund is reviewing a portfolio construction technique proposed by a new portfolio manager. The manager has recently been allocated capital to manage for an equity risk class. The Fund typically grants its portfolio managers flexibility in selecting and implementing appropriate portfolio construction procedures but requires that any methodology adopted fulfils key risk control objectives set by the firm. Which of the following portfolio construction techniques and its capability for risk control in portfolio construction is correct?

A. Quadratic programming allows for risk control through parameter estimation but generally requires many more inputs estimated from market data than other methods require.
B. The screening technique provides superior risk control by concentrating stocks in selected sectors based on expected alpha.
C. When using the stratification technique, risk control is implemented by overweighting the categories with lower risks and underweighting the categories with higher risks.
D. When using the linear programming technique, risk is controlled by selecting the portfolio with the lowest level of active risk.

Correct answer: A

Explanation: Quadratic programming requires many more inputs than other portfolio construction techniques because it entails estimating volatilities and pair-wise correlations between all assets in a portfolio. Quadratic programming is a powerful process, but given the large number of inputs it introduces the potential for noise and poor calibration given the less than perfect nature of most data.

On the other hand, the screening technique strives for risk control by including a sufficient number of stocks that meet the screening parameters and by weighting them to avoid concentrations in any particular stock. However, screening does not necessarily select stocks evenly across sectors and can ignore entire sectors or classes of stocks entirely if they do not pass the screen. Therefore, risk control in a screening process is fragmentary at best.
Stratification separates stocks into categories (for example, economic sectors) and implements risk control by ensuring that the weighting in each sector matches the benchmark weighting. Therefore, it does not allow for overweighting or underweighting specific categories.

Linear programming does not necessarily select the portfolio with the lowest level of active risk. Rather, it attempts to improve on stratification by introducing many more dimensions of risk control and ensuring that the portfolio approximates the benchmark for all these dimensions.

Section: Risk Management and Investment Management
Reference: Richard Grinold and Ronald Kahn, Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk, 2nd Edition (New York: McGraw-Hill, 2000). Chapter 14, Portfolio Construction.
Learning Objective: Evaluate the strengths and weaknesses of the following portfolio construction techniques: screens, stratification, linear programming, and quadratic programming.

24. An analyst reports the following fund information to the advisor of a pension fund that currently invests in government and corporate bonds and carries a surplus of USD 10 million:

Pension	Assets	Liabilities
Amount (USD million)	180	140
Expected annual growth	6%	10%
Modified duration	14	8
Annual volatility of growth	25%	12%

To evaluate the sufficiency of the fund's surplus, the advisor estimates the possible surplus values at the end of one year. The advisor assumes that annual returns on assets and the annual growth of the liabilities are jointly normally distributed and their correlation coefficient is 0.68. The advisor can report that, with a confidence level of 95%, the surplus value will be greater than or equal to:

A. USD -58.2 million
B. USD -22.0 million
C. USD 1.0 million
D. USD 21.0 million

Correct answer: B

Explanation: The lower bound of the 95% confidence interval is equal to:

Expected Surplus – (95% confidence factor * Volatility of Surplus).

The required variables can be calculated as follows: Variance of surplus (Variance$_S$):

$$V_S = V_A^2 * \sigma_A^2 + V_L^2 * \sigma_L^2 - 2 * V_A * V_L * \sigma_A * \sigma_L * \rho_{AL}$$

= 180^2*0.25^2 + 140^2*0.12^2 – 2*180*140*0.25*0.12*0.68 = 1,279.08; and so,

And, volatility of surplus (σ_S):

σ_S = sqrt(1,279.80) = USD 35.764 million

Thus, the expected surplus = V_A*(1 + R_A) – V_L*(1 + R_L) = 180*1.06 – 140*1.10 = USD 36.80 million.

Therefore, the lower bound of the 95% confidence interval = 36.80 – 1.645*35.764 = USD -22.032 million.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Distinguish among the following types of risk: absolute risk, relative risk, policy-mix risk, active management risk, funding risk, and sponsor risk.

25. A due diligence specialist at a company is evaluating the risk management process of a hedge fund in which the company is considering making an investment. Which of the following statements best describes criteria used for such an evaluation?

A. Because of the overwhelming importance of tail risk, the company should not invest in the fund unless it fully accounts for fat tails using extreme value theory at the 99.99% level when estimating VaR.
B. Today's best practices in risk management require that a fund employ independent risk service providers and that these service providers play important roles in risk-related decisions.
C. When considering a leveraged fund, the specialist should assess how the fund estimates risks related to leverage, including funding liquidity risks during periods of market stress.
D. It is crucial to assess the fund's valuation policy, and in general if more than 10% of asset prices are based on model prices or broker quotes, the specialist should recommend against investment in the fund regardless of other information available about the fund.

Correct answer: C

Explanation: Generally speaking, with a leveraged fund, an investor will need to evaluate historical and current changes in leverage, as well as the level of liquidity of the portfolio, particularly during times of market stress. Certain strategies may in fact expose an investor to tail risk, so while an investor should inquire whether the manager believes that tail risk exists, and whether or not it is hedged, it is then up to the investor to decide whether to accept the risk unhedged or hedge it on their own. Many funds employ independent risk service providers to report risks to investors, but these firms do not get involved in risk related decision making. And finally, while it is important to know what percentage of the assets is exchange-traded and marked to market, what might be acceptable may differ depending on the strategy of the fund.

Section: Risk Management and Investment Management
Reference: Kevin R. Mirabile, Hedge Fund Investing: A Practical Approach to Understanding Investor Motivation, Manager Profits, and Fund Performance (Hoboken, NJ: Wiley Finance, 2013). Chapter 11, Performing Due Diligence on Specific Managers and Funds.
Learning Objective: Describe criteria that can be evaluated in assessing a fund’s risk management process.

26. A packaging materials manufacturer is considering a project that has an estimated risk-adjusted return on capital (RAROC) of 15%. Suppose that the risk-free rate is 3% per year, the expected market rate of return is 11% per year, and the company's equity beta is 1.8. Using the criterion of adjusted risk-adjusted return on capital (ARAROC), the company should:

A. Reject the project because the ARAROC is higher than the market expected excess return.
B. Accept the project because the ARAROC is higher than the market expected excess return.
C. Reject the project because the ARAROC is lower than the market expected excess return.
D. Accept the project because the ARAROC is lower than the market expected excess return.

Correct answer: C

Explanation:
ARAROC = (RAROC – R_f)/β = (0.15 – 0.03)/1.8 = 6.67%.
Market excess return = $R_m - R_f$ = 0.11 – 0.03 = 8.0%.

where: R_f = risk-free rate of return
β = beta of company equity
R_m= market rate of return

As ARAROC is lower than the market excess return, the project should be rejected.

Section: Operational and Integrated Risk Management
Reference: Michel Crouhy, Dan Galai and Robert Mark, Risk Management, 2nd edition (New York: McGraw-Hill, 2014). Chapter 17, Risk Capital Attribution and Risk-Adjusted Performance Measurement.
Learning Objective: Compute the adjusted RAROC for a project to determine its viability.

27. A derivative trading firm only trades derivatives on rare commodities. The company and a handful of other firms, all of whom have large notional outstanding contracts with the company, dominate the market for such derivatives. The company's management would like to mitigate its overall counterparty exposure, with the goal of reducing it to almost zero. Which of the following methods, if implemented, could best achieve this goal?

A. Ensuring that sufficient collateral is posted by counterparties
B. Diversifying among counterparties
C. Cross-product netting on a single counterparty basis
D. Purchasing credit derivatives, such as credit default swaps

Correct answer: A

Explanation: Counterparty exposure, in theory, can be almost completely neutralized as long as a sufficient amount of high quality collateral, such as cash or short-term investment grade government bonds, is held against it. If the counterparty were to default, the holder of an open derivative contract with exposure to that counterparty would be allowed to receive the collateral. Cross-product netting would only reduce the exposure to one of the counter- parties, and purchasing credit derivatives would replace the counterparty risk from the individual counterparties with counterparty risk from the institution who wrote the CDS.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets (West Sussex, UK: John Wiley & Sons, 2012). Chapter 3, Defining Counterparty Credit Risk.
Learning Objective: Identify and describe the different ways institutions can manage and mitigate counterparty risk.

28. ADB Banking Corporation, a frequent user of swaps, often enters into transactions with HIP Bank, a major provider of swaps. Recently, HIP Bank was downgraded from a rating of A to a rating of A-, while ADB Banking Corporation was downgraded from a rating of A- to a rating of BBB. During this time, the credit spread for HIP Bank has increased from 36 bps to 144 bps, while the credit spread for ADB Banking has increased from 114 bps to 156 bps. Which of the following is the most likely action that the counterparties will request on their credit value adjustment (CVA)?

A. The credit qualities of the counterparties have migrated, but not significantly enough to justify amending existing CVA arrangements.
B. HIP Bank requests an increase in the CVA charge it receives.
C. ADB Banking Corporation requests a reduction in the CVA charge it pays.
D. CVA is no longer a relevant factor, and the counterparties should migrate to using other mitigants of counterparty risk.

Correct answer: C

Explanation: Because ADB Banking Corporation has a lower credit rating than HIP Bank, it would typically pay a CVA charge to HIP Bank which would be a function of the relative credit spread between the two banks. After the downgrades of both HIP Bank and ADB Banking Corporation, the credit spread between the two firms narrowed from 78 bps initially to only 12 bps after the downgrades. Therefore, with the spread much lower between the two banks, ADB Banking Corporation would be in a position to request a reduction in the CVA charge that it pays.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets (West Sussex, UK: John Wiley & Sons, 2012). Chapter 12, "Credit Value Adjustment."
Learning Objective: Explain the motivation for and the challenges of pricing counterparty risk.

29. A risk analyst estimates that the hazard rate for a company is 0.10 per year. The probability of survival in the first year followed by a default in the second year is closest to:

A. 8.6%
B. 9.5%
C. 18.1%
D. 22.1%

Correct answer: B

Explanation: The probability that the firm defaults in the second year is conditional on its surviving the first year. Using λ to represent the given hazard rate, we can calculate the cumulative probability of default in the first year using the formula 1– exp(–1*λ) = 1 – exp(-0.10) = 0.0952. Thus, probability of survival in the first year = 1 – 0.0952 = 0.9048.

Then, the cumulative probability that the firm defaults in the second year = 1 – exp(–2*λ) = 1 – exp(-2*0.10) = 0.1813, and the conditional one year default probability given that the firm survived the first year is the difference between the two year cumulative probability of default and the one year probability divided by the probability of survival in the first year = (0.1813 – 0.0952)/0.9048 = 0.0952 = 9.52%.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Define the hazard rate and use it to define probability functions for default time and condition- al default probabilities.

30. Computing VaR on a portfolio containing a very large number of positions can be simplified by mapping these positions to a smaller number of elementary risk factors. Which of the following is correct?

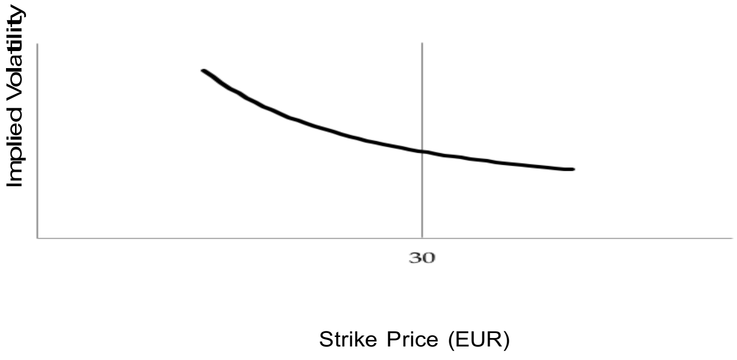
A. USD/EUR forward contracts are mapped on the USD/EUR spot exchange rate.
B. Each position in a corporate bond portfolio is mapped on the bond with the closest maturity among a set of government bonds.
C. Zero-coupon government bonds are mapped on government bonds paying regular coupons.
D. A position in the stock market index is mapped on a position in a stock within that index.

Correct answer: A

Explanation: Mapping several USD/EUR forward contracts to USD/EUR spot exchange rate is an adequate process, because all the forward positions are exposed to a single major risk factor, which is the USD/EUR spot exchange rate. However, this is not a perfect mapping (for instance, the sensitivity of both the forward and the spot exchange rates to a specific risk factor such as changes in interest rates, may differ). While the single aggregation of exposure of this risk factor is acceptable for risk measurement, it is not adequate for pricing of the portfolio.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 11, VaR Mapping.
Learning Objective: Explain the principles underlying VaR mapping, and describe the mapping process.

31. A risk manager is in the process of valuing several European-type option positions on a non-dividend-paying stock XYZ that is currently priced at EUR 30. The implied volatility skew, estimated using the Black-Scholes-Merton model and the current prices of actively traded European-style options on stock XYZ at various strike prices, is shown below:



Assuming that the implied volatility at EUR 30 is used to conduct the valuation, which of the following long positions will be overvalued?

A. An in-the-money call
B. An in-the-money put
C. An out-of-the-money call
D. An out-of-the-money put

Correct answer: C

Explanation: An out-of-the-money call has a strike price above 30. Therefore, using the chart above, its implied volatility is less than the at-the-money volatility, so using the at-the-money implied volatility would result in pricing an out-of-the-money call option higher than its fair price.

Section: Market Risk Measurement and Management
Reference: John Hull, Options, Futures, and Other Derivatives, 9th Edition (New York: Pearson, 2014). Chapter 20, Volatility Smiles.
Learning Objective: Compare the shape of the volatility smile (or skew) to the shape of the implied distribution of the underlying asset price and to the pricing of options on the underlying asset.

32. A financial analyst is pricing a 5-year call option on a 5-year Treasury note using a successfully tested pricing model. Current interest rate volatility is high and the analyst is concerned about the effect this may have on short-term rates when pricing the option. Which of the following actions would best address the potential for negative short-term interest rates to arise in the model?

- **A.** When short-term rates are negative, the financial analyst adjusts the risk-neutral probabilities.
- **B.** When short-term rates are negative, the financial analyst increases the volatility.
- **C.** When short-term rates are negative, the financial analyst sets the rate to zero.
- **D.** When short-term rates are negative, the financial analyst sets the mean-reverting parameter to 1.

Correct answer: C

Explanation: Negative short-term interest rates can arise in models for which the terminal distribution of interest rates follows a normal distribution. The existence of negative interest rates does not make much economic sense since market participants would generally not lend cash at negative interest rates when they can hold cash and earn a zero return. One method that can be used to address the potential for negative interest rates when constructing interest rate trees is to set all negative interest rates to zero. This localizes the change in assumptions to points in the distribution corresponding to negative interest rates and preserves the original rate tree for all other observations. In comparison, adjusting the risk neutral probabilities would alter the dynamics across the entire range of interest rates and therefore not be an optimal approach.

When a model displays the potential for negative short-term interest rates, it can still be a desirable model to use in certain situations, especially in cases where the valuation depends more on the average path of the interest rate, such as in valuing coupon bonds. Therefore, the potential for negative rates does not automatically rule out the use of the model.

Section: Market Risk Measurement and Management
Reference: Bruce Tuckman, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, The Art of Term Structure Models: Drift.
Learning Objective: Describe methods for addressing the possibility of negative short-term rates in term structure models.

33. An investment bank has been using VaR as its main risk measurement tool. ES is suggested as a better alternative to use during market turmoil. What should be understood regarding VaR and ES before modifying current practices?

A. Compared to VaR, ES leads to more required economic capital for the same confidence level.
B. If a VaR backtest at a specified confidence level is accepted, then the corresponding ES will always be accepted.
C. While VaR ensures that the estimate of portfolio risk is less than or equal to the sum of the risks of that portfolio's positions, ES does not.
D. While ES is more complicated to calculate than VaR, it is easier to backtest than VaR.

Correct answer: A

Explanation: Expected shortfall is always greater than or equal to VaR for a given confidence level, since ES accounts for the severity of expected losses beyond a particular confidence level, while VaR measures the maximum expected loss at that confidence level. Therefore, ES would lead to a higher level of required economic capital than VaR for the same confidence level. In practice, however, regulators often correct for the difference between ES and VaR by lowering the required confidence level for banks using ES compared to those using VaR.

Section: Market Risk Measurement and Management
Reference: Basel Committee on Banking Supervision, "Messages from the Academic Literature on Risk Measurement for the Trading Book," Working Paper No. 19, January 2011.
Learning Objective: Compare VaR, expected shortfall, and other relevant risk measures.

QUESTION 34 REFERS TO THE FOLLOWING INFORMATION

A derivative trading desk at a bank decides that its existing VaR model, which has been used broadly across the firm for several years, is too conservative. The existing VaR model uses a historical simulation over a three-year look-back period, weighting each day equally. A quantitative analyst in the group quickly develops a new VaR model, which uses the delta normal approach. The new model uses volatilities and correlations estimated over the past four years using the RiskMetrics EWMA method.

For testing purposes, the new model is used in parallel with the existing model for six weeks to estimate the 1-day 99% VaR. After six weeks, the new VaR model has no exceedances despite consistently estimating VaR to be considerably lower than the existing model's estimates. The analyst argues that the lack of exceedances shows that the new model is unbiased and pressures the bank’s model evaluation team to agree. Following an overnight examination of the new model by one junior analyst instead of the customary evaluation that takes several weeks and involves a senior member of the team, the model evaluation team agrees to accept the new model for use by the desk.

34. Which of the following statements about the risk management implications of this replacement is correct?

- **A.** Delta-normal VaR is more appropriate than historical simulation VaR for assets with non-linear payoffs.
- **B.** Changing the look-back period and weighing scheme from three years, equally weighted, to four years, exponentially weighted, will understate the risk in the portfolio.
- **C.** The desk increased its exposure to model risk due to the potential for incorrect calibration and programming errors related to the new model.
- **D.** A 99% VaR model that generates no exceedances in six weeks is necessarily conservative.

Correct answer: C

Explanation: Given the quick implementation of the new VaR model and the insufficient amount of testing that was done, the desk has increased its exposure to model risk due to the increased potential for incorrect calibration and programming errors. This situation is similar to the JP Morgan London Whale case in 2012, where a new VaR model was very quickly introduced for its Synthetic Credit portfolio without appropriate time to test the model in response to increasing losses and multiple exceedances of the earlier VaR model limit in the portfolio.

Section: Operational and Integrated Risk Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 11, Assessing the Quality of Risk Measures.
Learning Objective: Describe ways that errors can be introduced into models.

35. A hedge fund has a 25,000 share position in an undervalued and relatively illiquid stock XYZ that has a current stock price of GBP 48 (expressed as the midpoint of the current bid-ask spread). The daily return for XYZ has a mean of 0%, an estimated volatility of 0.32% and a volatility spread of 0.0016. The average bid-ask spread is GBP 0.22. The risk division of the fund usually assumes that the returns are normally distributed and estimates the liquidity adjusted 1-day 95% VaR of the position using the constant spread approach. Suppose that the CRO asks the risk division to determine the liquidity adjusted 1-day 95% VaR using the exogenous spread approach instead, assuming the volatility spread multiplier k of 3. What would be the increase in the liquidity adjustment?

- **A.** 43.65%
- **B.** 45.71%
- **C.** 69.61%
- **D.** 89.36%

Correct answer: B

Explanation: Before considering liquidity adjustment, the 1-day 95% VaR of the position is obtained as:

VaR = P[1 – exp(μ – σz)] = GBP 48*25,000*[1 – exp(0 – 0.0032*1.645)] = GBP 6,300.20

The liquidity adjusted VaR (LVaR) derived using the **constant spread approach** adds half of the bid-ask spread (as a percent) to the VaR calculation, using the following formula:

LVaR = VaR + Liquidity Cost (LC) = VaR + ½*(Spread * P)

where Spread is equal to the actual spread divided by the midpoint and P is the value of the position.

Therefore,

Daily 95% VaR = (48*25,000)*[1 – exp(0 – 1.645*0.0032)] = GBP 6,300.20
Liquidity cost = (0.5)*(0.22/48)*(48*25,000) = GBP 2,750

And so,

LVaR = VaR + LC = GBP 9,050.20 and so, the liquidity adjustment = 2,750/6,300.20 = 43.65% of VaR.

Using the exogenous spread approach, the liquidity cost (LC) is derived by

LC = (0.5)(48*25,000)*[(0.22/48) + (3*0.0016)] = 2,750 + 2,880 = GBP 5,630

The LVaR using the exogenous approach will be higher than LVaR obtained using the constant spread approach by GBP 5,630 and so, the liquidity adjustment = 5.630/6,300.20 = 89.36% of VaR.

Therefore, the increase in the liquidity adjustment when using the exogenous approach compared to using the constant spread approach = 89.36 – 43.65 = 45.71%

Section: Operational and Integrated Risk Management
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 14, Estimating Liquidity Risks.
Learning Objective: Describe and calculate LVaR using the constant spread approach and the exogenous spread approach.

36. The Basel Committee recommends that banks use a set of early warning indicators in order to identify emerging risks and potential vulnerabilities in their liquidity position. Which of the following is an early warning indicator of a potential liquidity problem?

A. Credit rating upgrade
B. Increased asset diversification
C. Rapid asset growth
D. Positive publicity

Correct answer: C

Explanation: Rapid asset growth is an early warning of a potential liquidity problem. Positive publicity, credit rating upgrade, and increased asset diversification are all not early warnings of a potential liquidity problem.

Section: Operational and Integrated Risk Management
Reference: Darrell Duffie, The Failure Mechanics of Dealer Banks, Journal of Economic Perspectives (2010, Volume 24, Number 1) pp. 51-72.
Learning Objective: Identify situations that can cause a liquidity crisis at a dealer bank and explain responses that can mitigate these risks.

37. Large dealer banks have often financed significant fractions of their assets using short-term (overnight) repurchase agreements in which creditors hold bank securities as collateral against default losses. The table below shows the quarter-end financing of four broker-dealer financial instruments. All values are in USD billions.

	Bank P	**Bank Q**	**Bank R**	**Bank S**
Financial Instruments Owned	656	750	339	835
Pledged as collateral	258	472	139	209
Not pledged	398	278	200	626

In the event that repo creditors become equally nervous about each bank's solvency, which bank is most vulnerable to a liquidity crisis?

A. Bank P
B. Bank Q
C. Bank R
D. Bank S

Correct answer: B

Explanation:

	Bank P	**Bank Q**	**Bank R**	**Bank S**
Financial Instruments Owned	656	750	339	835
Pledged as collateral	258	472	139	209
Not pledged	398	278	200	626
Fraction Pledged	39%	63%	41%	25%

A liquidity crisis could materialize if repo creditors become nervous about a bank's solvency and choose not to renew their positions. If enough creditors choose not to renew, the bank could likely be unable to raise sufficient cash by other means on such short notice, thereby precipitating a crisis. However, this vulnerability is directly related to the proportion of assets a bank has pledged as collateral.

Bank Q is most vulnerable since it has the largest dependence on short-term repo financing (i.e. the highest percentage of its assets out of the four banks is pledged as collateral.

Section: Operational and Integrated Risk Management
Reference: Darrell Duffie, The Failure Mechanics of Dealer Banks, Journal of Economic Perspectives (2010, Volume 24, Number 1) pp. 51-72.
Learning Objective: Identify situations that can cause a liquidity crisis at a dealer bank and explain responses that can mitigate these risks.

38. During a training seminar, a supervisor at Firm W discusses different types of operational risk that the firm may face, which could be in the short-term or over the long-term period. Which of the following is an example of an operational risk loss by Firm W?

- **A.** After a surprise announcement by the central bank that interest rates would increase, bond prices fall, and Firm W incurs a significant loss on its bond portfolio.
- **B.** The data capture system of Firm W fails to capture the correct market rates causing derivative trades to be done at incorrect prices, leading to significant losses.
- **C.** As a result of an increase in commodity prices, the share price of a company that Firm W invested in falls significantly, causing major investment losses.
- **D.** A counterparty of Firm W fails to settle their debt to Firm W, and in doing this, they are in breach of a legal agreement to pay for services rendered.

Correct answer: B

Explanation: B is correct. In B, systems failure or incorrect systems caused the problem. The losses are directly due to an operational risk exposure. In A and C, an increase in interest rates and the fall in the value of an investment, respectively, are both examples of market risk exposure. In D, failure to repay debt, is an example of credit risk exposure.

Section: Operational and Integrated Risk Management
Reference: “Principles for the Sound Management of Operational Risk,” (Basel Committee on Banking Supervision Publication, June 2011).
Learning Objective: Describe tools and processes that can be used to identify and assess operational risk.

39. The risk management group estimates the 1-day 99% VaR on a long-only, large-cap equity portfolio using a variety of approaches. A daily risk report shows the following information:

Approach	**1-day 99% VaR (EUR)**
Delta-Normal	300,000
Monte Carlo Simulation	332,000
Historical Simulation	66,000

Which of the following is the most likely explanation for the variation in VaR estimates?

A. Data problems
B. Differences in model assumptions
C. Endogenous model risk
D. Programming errors

Correct answer: B

Explanation: VaR measures will vary according to the approach (delta-normal, historical simulation, Monte Carlo simulation). The variation in these values does not suggest bigger problems with data or programming/implementation nor is there any reason to suspect endogenous model risk (e.g., traders gaming the system to lower risk values).

Section: Operational and Integrated Risk Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 11, Assessing the Quality of Risk Measures.
Learning Objective: Describe how horizon, computational and modeling decisions can impact VaR estimates.

40. A risk analyst is building a bank's enterprise risk management system. During the process, the analyst takes an inventory of firm risks and categorizes these risks as market, credit, or operational. Which of the following observations of the bank's data should be considered unexpected if compared to similar industry data?

A. The operational risk loss distribution has a large number of small losses, and therefore a relatively low mode.
B. The operational risk loss distribution is symmetric and fat-tailed.
C. The credit risk distribution is asymmetric and fat-tailed.
D. The market risk distribution is similar to the distribution of the return on a portfolio of securities.

Correct answer: B

Explanation: B is correct. Statements A, C, and D are consistent with industry data. However, with operational risk, there tends to be large numbers of small losses and a small number of large losses, so the distribution is asymmetric (and fat-tailed).

Section: Operational and Integrated Risk Management
Reference: Brian Nocco and René Stulz, Enterprise Risk Management: Theory and Practice, Journal of Applied Corporate Finance (Volume 18, Number 4, 2006), pp. 8 – 20.
Learning Objective: Describe the development and implementation of an ERM system, as well as challenges to the implementation of an ERM system.

41. A regional commercial bank is considering a loan to be fully funded entirely by deposits, with the following parameters:

- Loan amount: JPY 3.2 billion
- Average annual interest rate paid on deposits: 0.6%
- Annual interest rate on loan: 4.5%
- Expected loss: 3.0% of face value of loan
- Annual operating costs: 0.3% of face value of loan
- Economic capital need: 8.5%
- Average return on economic capital: 1.2%
- Effective tax rate: 34%

What is the risk-adjusted after-tax return on capital (RAROC) for this loan?

A. 1.2%
B. 1.8%
C. 14.0%
D. 21.2%

Correct answer: C

Explanation: The risk-adjusted after-tax return on capital (RAROC) is computed by:

$$RAROC = \frac{\mathrm{Re}\,venue + Income - Interest - Operating\ \ Cost - Loss - Taxes}{Economic\ \ Capital}$$

Where:
Economic Capital = JPY 3,200,000,000 x 0.085 = JPY 272,000,000
Revenue = expected revenue = JPY 3,200,000,000 x 0.045 = JPY 144,000,000
Income = return on invested economic capital = JPY 3,200,000,000 x 0.012 = JPY 38,400,000
Interest = interest expense = JPY 3,200,000,000 x 0.006 = JPY 19,200,000
Operating Cost = JPY 3,200,000,000 x 0.003 = JPY 9,600,000
Loss = expected loss = JPY 3,200,000,000 x 0.03 = JPY 96,000,000
Taxes = (Rev + Inc – Int – OC – Loss)*(0.34)
= (144,000,000 + 38,400,000 – 19,200,000 – 9,600,000 – 96,000,000)*(0.34)
= (JPY 57,600,000)*(0.34) = JPY 19,584,400

Therefore, numerator = JPY 38,015,600 and so,

$$RAROC \ = \frac{38{,}015{,}600}{272{,}000{,}000} = 0.1398 = 13.98\% = 14.0\%$$

Section: Operational and Integrated Risk Management
Reference: Michel Crouhy, Dan Galai and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 17, Risk Capital Attribution and Risk-Adjusted Performance Measurement.
Learning Objective: Compute and interpret the RAROC for a project, loan, or loan portfolio, and use RAROC to compare business unit performance.

42. A bank uses VaR and stressed VaR market risk framework in line with the Basel requirements. The bank's internal models for market risk have generated the following risk measures (in USD million) for the current trading book positions:

Confidence Level	**Latest Available 10-day VaR**	**Latest Available 10-day Stressed VaR**	**Average 10-day VaR of Previous 60 Days**	**Average 10-day Stressed VaR of Previous 60 Days**
95.0%	228	498	255	557
99.0%	441	1,009	416	1,117
99.9%	568	1,295	531	1,383

Assuming the supervisory authority has set the multiplication factors for both the VaR and stressed VaR values to 3, what is the correct capital requirement for general market risk for the bank?

- **A.** USD 1,248 million
- **B.** USD 1,533 million
- **C.** USD 4,350 million
- **D.** USD 4,599 million

Correct answer: D

Explanation:
The revised market risk capital requirement (at 99.0% level) is:

Market Risk Capital = $\max(VaR_{t-1}, m_c*VaR_{60\text{-day Avg}}) + \max(sVaR_{t-1}, m_s*sVaR_{60\text{-day Avg}})$
= max(441, 3*416) + max(1,009, 3*1,117)
= USD 1,248 million + USD 3,351 = USD 4,599 million

Section: Operational and Integrated Risk Management
Reference: John Hull, Risk Management and Financial Institutions, 4th Edition (New York: John Wiley & Sons, 2015). Chapter 16, Basel 2.5, Basel III, and Other Post-Crisis Changes.
Learning Objective: Describe and calculate the stressed value-at-risk measure introduced in Basel 2.5, and calculate the market risk capital charge.

43. Company OBD has an outstanding zero-coupon bond with 1 year remaining to maturity. The bond has a face value of USD 1,000,000 and a recovery rate of 0%. The bond is currently trading at 84% of face value. Assuming the excess spread only captures credit risk and that the risk-free rate is 2.5% per annum, what is the approximate risk-neutral 1-year probability of default of Company OBD?

A. 12%
B. 14%
C. 17%
D. 19%

Correct answer: B

Explanation: This can be calculated by using the formula which equates the future value of a risky bond with yield (y) and default probability (p) to a risk free asset with yield (r). That is,

$1 + r = (1 - \pi) * (1 + y) + \pi R$

where π = Probability of default and R = Recovery rate

In the situation where the recovery rate is assumed to be zero, the risk-neutral probability of default can be derived from the following equation:

$1 + r = (1 - \pi) * (FV/MV)$

where MV = market value and FV = face value. Therefore,

$n = 1 - [(1 + r)(MV)/FV]$

Inputting the data into this equation yields $\pi = 1 - [(1.025)*(0.84)/1{,}000{,}000] = 0.1390 = 13.9\% = 14\%$.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Calculate risk-neutral default rates from spreads.

44. An insurance company is considering taking positions in various tranches of a collateralized debt obligation (CDO). The company's CRO predicts that the default probability will decrease significantly and that the default correlation will increase. Based on this prediction, which of the following is a good strategy to pursue?

A. Buy the senior tranche and buy the equity tranche.
B. Buy the senior tranche and sell the equity tranche.
C. Sell the senior tranche and sell the equity tranche.
D. Sell the senior tranche and buy the equity tranche.

Correct answer: D

Explanation: The decrease in probability of default would increase the value of the equity tranche. Also, a default of the equity tranche would increase the probability of default of the senior tranche, due to increased correlation, reducing its value. Thus, it is better to go long the equity tranche and short the senior tranche.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, Structured Credit Risk.
Learning Objective: Explain how the default probabilities and default correlations affect the credit risk in a securitization.

45. A financial institution has many open derivative positions with an investment company. A description and current market values are displayed in the table below:

Position	**Price (USD)**
Long swaptions	29 million
Long credit default swaps	11 million
Short currency derivatives	18 million
Short interest rate swaps	7 million

In the event that the investment company defaults, what would be the loss to the financial institution if netting is used compared to the loss if netting is not used?

A. Loss of USD 11 million if netting is used; loss of USD 25 million if netting is not used
B. Loss of USD 11 million if netting is used; loss of USD 40 million if netting is not used
C. Loss of USD 15 million if netting is used; loss of USD 25 million if netting is not used
D. Loss of USD 15 million if netting is used; loss of USD 40 million if netting is not used

Correct answer: B

Explanation: Netting means that the payments between the two counterparties are netted out, so that only a net payment has to be made. With netting, the investment firm is not required to make every payout, hence the loss will be reduced to: USD 29 million + USD 11 million – USD 18 million – USD 7 million = USD 15 million. Without netting, the loss is the outstanding long position: USD 29 million + USD 11 million = USD 40 million.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, Structured Credit Risk.
Learning Objective: Explain how the default probabilities and default correlations affect the credit risk in a securitization.
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets (West Sussex, UK: John Wiley & Sons, 2012). Chapter 4, Netting, Compression, Resets, and Termination Features.
Learning Objective: Describe the effectiveness of netting in reducing credit exposure under various scenarios.

46. A derivative trading firm sells a European-type call option on stock JKJ with a time to expiration of 9 months, a strike price of EUR 45, an underlying asset price of EUR 67, and implied annual volatility of 27%. The annual risk-free interest rate is 2.5%. What is the firm's counterparty credit exposure from this transaction?

A. EUR 0.00
B. EUR 9.45
C. EUR 19.63
D. EUR 22.00

Correct answer: A

Explanation: Selling an option exposes the firm to zero counterparty credit risk as the premium is paid up front. However, buying an option would expose the firm to a counterparty credit risk. The correct answer is therefore A. All the information necessary to price the option is provided but it is not necessary.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 3, Defining Counterparty Credit Risk.
Learning Objective: Describe transactions that carry counterparty risk and explain how counterparty risk can arise in each transaction.

47. An endowment fund has sold default protection on the most senior tranche of a CDO. If the default correlation between assets held in the CDO decreases sharply, assuming everything else is unchanged, how will the position of the endowment fund be impacted?

A. It will either increase or decrease, depending on the pricing model used and the market conditions.
B. It will gain significant value, since the probability of exercising the protection falls.
C. It will lose significant value, since the protection will gain value.
D. It will neither gain nor lose value, since only expected default losses matter and correlation does not affect expected default losses.

Correct answer: B

Explanation: The senior tranche will gain value if the default correlation decreases. High correlation implies that if one name defaults, a large number of other names in the CDO will also default. Low correlation implies that if one name defaults, there would be little impact on the default probability of the other names. Therefore, as the correlation decreases, the cumulative probability of enough defaults occurring to exceed the credit enhancement on the senior tranche will also decrease. Hence the investor who has sold protection on the senior tranche will see a gain.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, Structured Credit Risk.
Learning Objective: Explain how the default probabilities and default correlations affect the credit risk in a securitization.

48. A hedge fund manages a portfolio of equity options. Among them are options written by a financial institution on its own stock. Assuming the financial institution could write one of the following options, which option would give the highest wrong-way risk?

A. An in-the-money call option
B. An in-the-money put option
C. An out-of-the-money call option
D. An out-of-the-money put option

Correct answer: D

Explanation:
D is correct. "Buying a put option on a stock (or stock index) where the underlying in question has fortunes that are highly correlated to those of the counterparty is an obvious case of wrong-way risk" (CR 2017, reference below). Thus, choices A and C are ruled out.

Also, according to CR 2017, "an out-of-the-money put option will have more wrong- way risk than an in-the-money one." That implies option D is the only correct one.

Section: Credit Risk Measurement and Management
Reference: René Stulz, Risk Management & Derivatives (Florence, KY: Thomson South-Western, 2002). Chapter 18, Credit Risks and Credit Derivatives.
Learning Objective: Assess the credit risks of derivatives.

49. Four derivative counterparties have undertaken bilateral netting arrangements. The exhibit below presents a summary of their bilateral mark-to-market (MtM) trades. If netting agreements exist between all pairs of counterparties shown, what is the correct order of net exposure per counterparty, from highest to lowest?

Mark-to-Market Trades for Four Counterparties (USD million)				
		Opposing Counterparty		
		Q	**R**	**S**
Counterparty **P**	Trades with positive MtM	8	10	4
	Trades with negative MtM	-6	-2	-4
		P	**R**	**S**
Counterparty **Q**	Trades with positive MtM	15	6	7
	Trades with negative MtM	-16	0	-8
		P	**Q**	**S**
Counterparty **R**	Trades with positive MtM	6	4	8
	Trades with negative MtM	-6	-5	-12
		P	**Q**	**R**
Counterparty **S**	Trades with positive MtM	2	13	1
	Trades with negative MtM	-2	-10	-1

A. P, Q, S, R
B. Q, R, S, P
C. R, Q, P, S
D. S, P, Q, R

Correct answer: A

Explanation: The properly netted amounts are:
For counterparty P: Q = 8-6= $2; R = 10-2 = $8; S = 4-4 = 0; for a sum of **$10.**
For counterparty Q: P = 15-16 =-1 = $0, R = 6-0 = $6; S = 7-8 = -1 = $0; for a sum of **$6.**
For counterparty R: P = 6-6 = $0; Q = 4-5 =-1 = $0; S = 8-12=-4 = $0; for a sum of **$0.**
For counterparty S: P = 2-2 = $0, Q = 13-10 = $3; R = 1-1 = $0; for a sum of **$3.**

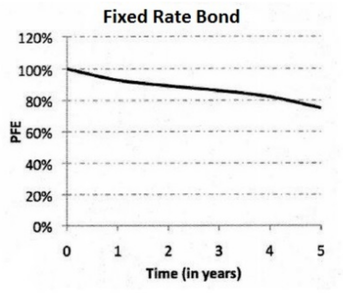
Therefore, the correct sequence of net exposure amounts per counterparty, from highest to lowest, is P, Q, S,
and R.

Note that a negative netted amount means the counterparty has no exposure.

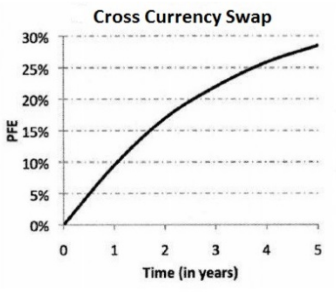
Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 4, Netting, Compression, Resets, and Termination Features.
Learning Objective: Describe the effectiveness of netting in reducing credit exposure under various scenarios.

50. Interest rate and currency swaps display differing profiles of potential future exposure (PFE) over time. Which of the following graphs is an accurate representation of a typical PFE profile for the corresponding instrument?

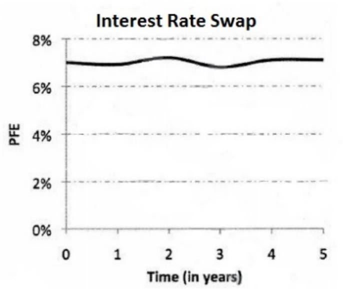
A



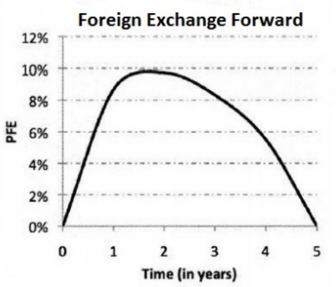
B.



C



D.



Correct answer: B

Explanation: The risk of cross-currency swaps is driven by a large final payoff, and thus the profile increases monotonically until the maturity of the trade. The FX risk of the notional exchange dominates the small contribution due to interest rate exposure.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 8, Credit Exposure.
Learning Objective: Identify typical credit exposure profiles for various derivative contracts and combination profiles.

51. A risk analyst is examining a firm's foreign currency option price assumptions. The observed volatility smile for a particular foreign currency option slopes progressively higher as an option moves either into the money or out of the money. Compared to the lognormal distribution with the same mean and standard deviation, the distribution of option prices on this foreign currency implied by the Black-Scholes-Merton (BSM) model would have:

A. A heavier left tail and a less heavy right tail.
B. A heavier left tail and a heavier right tail.
C. A less heavy left tail and a heavier right tail.
D. A less heavy left tail and a less heavy right tail.

Correct answer: B

Explanation: For foreign currency option, the implied distribution gives a relatively high price for the option. The implied volatility is relatively low for at-the-money options but it becomes higher as the option moves either into the money or out of the money. Thus, the implied distribution has heavier tails than the lognormal distribution. For an equity index option price distribution, a downward sloping volatility skew indicates that out of the money puts are more expensive than predicted by the Black-Scholes-Merton model and out of the money calls are cheaper than expected predicted by the Black-Scholes-Merton model. The implied distribution of equity options has heavier left tails and less heavy right tails, compared to the lognormal distribution.

Section: Market Risk Measurement and Management
Reference: John Hull, Options, Futures, and Other Derivatives, 9th Edition (New York: Pearson, 2014). Chapter 20, Volatility Smiles.
Learning Objective: Compare the shape of the volatility smile (or skew) to the shape of the implied distribution of the underlying asset price and to the pricing of options on the underlying asset.

52. A wealth management firm has INR 56 billion in assets. The portfolio manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (INR)
95.0%	226,665,000
95.5%	230,197,500
96.0%	234,000,000
96.5%	244,237,500
97.0%	253,012,500
97.5%	261,787,500
98.0%	272,317,500
98.5%	286,357,500
99.0%	304,785,000
99.5%	333,157,500

What is the closest estimate of the daily ES at the 97.5% confidence level?

- **A.** INR 262 million
- **B.** INR 264 million
- **C.** INR 292 million
- **D.** INR 299 million

Correct answer: D

Explanation: An estimate of the expected shortfall (ES) can be obtained by taking the average of the VaRs for the various confidence levels that are greater than 96.5%. Therefore,

ES = (272,317,500 + 286,357,500 + 304,785,000 + 333,157,500)/4 = INR 299,154,375

Section: Market Risk Measurement and Management
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 3, Estimating Market Risk Measures: An Introduction and Overview.
Learning Objective: Estimate the expected shortfall given P/L or return data.

53. A newly hired risk analyst is backtesting a firm's VaR model. Previously, the firm calculated a 1-day VaR at the 95% confidence level. Following the Basel framework, the risk analyst is recommending that the firm switch to a 99% confidence level. Which of the following statements concerning this switch is correct?

A. The decision to accept or reject a VaR model based on backtesting results is less reliable with a 99% confidence level VaR model than with a 95% confidence level model.
B. The 95% VaR model is less likely to be rejected using backtesting than the 99% VaR model.
C. When validating with backtesting at the 90% confidence level, there is a smaller probability of incorrectly rejecting a 95% VaR model than a 99% VaR model.
D. When backtesting using a 90% confidence level, there is a smaller probability of committing a type I error when backtesting a 95% VaR model than with a 99% VaR model.

Correct answer: A

Explanation: The concept tested here is the understanding of the difference between the VaR parameter for confidence (here, namely 95% vs. 99%) and the validation procedure confidence level, and how they interact with one another. Using a 95% VaR confidence level creates a narrower rejection region by allowing a greater number of exceptions to be generated. This in turn increases the power of the backtesting process and makes for a more reliable test than using a 99% confidence level.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 6, Backtesting VaR.
Learning Objective: Define and identify type I and type II errors.

54. A hedge fund risk manager is looking at various models that are flexible enough to incorporate mean reversion and risk premium into term structure modeling. Which of the following is correct about the Vasicek model?

A. It incorporates mean reversion but not drift into the interest rate model.
B. It incorporates mean reversion into the model and allows for a risk premium as a constant or changing drift.
C. It does not incorporate risk premium and the term structure of interest rate volatility in the model is upward-sloping.
D. It does not incorporate mean reversion into the model but allows for a risk premium to be applied to interest rates that change over time.

Correct answer: B

Explanation: Choice B is correct: the Vasicek model incorporates mean reversion. The flexibility of the model also allows for risk premium, which enters into the model as constant drift or a drift that changes over time.

Section: Market Risk Measurement and Management
Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Editio*n* (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, The Art of Term Structure Models: Drift.
Learning Objective: Construct a short-term rate tree under the Ho-Lee Model with time-dependent drift.

55. A hedge fund that runs a distressed securities strategy is evaluating the solvency conditions of two potential investment targets. Currently firm RST is rated BB and firm WYZ is rated B. The hedge fund is interested in determining the joint default probability of the two firms over the next two years using the Gaussian default time copula under the assumption that a one-year Gaussian default correlation is 0.36. The fund reports that x_{BB} and x_B are mapped abscise values of the bivariate normal distribution presented in the table below, while Q and N denote the cumulative default probability and the standard normal distribution, respectively:

Default Time in Year	**Firm RST Default Probability**	**Firm RST Cumulative Default Probability $Q_{BB}(t)$**	**Firm RST Cumulative Standard Normal Percentiles $N^{-1}(Q_{BB}(t))$**	**Firm WYZ Default Probability**	**Firm WYZ Cumulative Default Probability $Q_B(t)$**	**Firm WYZ Cumulative Standard Normal Percentiles $N^{-1}(Q_B(t))$**
1	5.21%	5.21%	– 1.2104	19.06%	19.06%	– 0.5694
2	6.12%	11.33%	– 0.8586	10.63%	29.69%	– 0.2630
3	5.50%	16.83%	– 0.6443	8.24%	37.93%	– 0.0516
4	4.81%	21.64%	– 0.4893	6.10%	44.03%	– 0.1015
5	4.22%	25.86%	– 0.3672	4.03%	48.06%	– 0.2046

Applying the Gaussian copula, which of the following best describes the derivation of the joint probability(Q) that firm RST and firm WYZ will both default in year 2?

A. $Q(x_{BB} = 0.0612) + Q(x_B = 0.1063) - Q(x_{BB} = 0.0612)*Q(x_B = 0.1063)$
B. $Q(x_{BB} = 0.1133) + Q(x_B = 0.2969) - Q(x_{BB} = 0.1133)*Q(x_B = 0.2969)$
C. $Q(x_{BB} \leq 0.1133 \cap x_B \leq 0.2969)$
D. $Q(x_{BB} \leq -0.8586 \cap x_B \leq -0.2630)$

Correct answer: D

Explanation: D is correct. The joint probability of default is measured by “cumulative standard normal percentiles.” What the copula function does is to: first, map the cumulative default probability values (marginal distributions) of a multivariate distribution - percentile to percentile - to a cumulative standard normal distribution. Then, second, find the mapped abscise (x-axis) values of the cumulative standard normal distribution. The Gaussian copula procedure essentially assumes that only a single correlation (not a correlation matrix) can now be applied to the multivariate distribution.

A is incorrect. It expresses the joint probability of default for firms RST and WYZ while ignoring the effect of correlation.

B is incorrect. It expresses the joint probability of default for firms RST and WYZ while ignoring the effect of correlation but it also incorrectly uses cumulative default probabilities instead of default probabilities in that formula.

C is incorrect. It incorrectly expresses the joint probability of default of firms RST and WYZ by using cumulative default probabilities instead of the cumulative standard normal percentiles.

Section: Market Risk Measurement and Management
Reference: Gunter Meissner, *Correlation Risk Modeling and Management* (New York: John Wiley & Sons, 2014). Chapter 4, Financial Correlation Modeling—Bottom-Up Approaches.
Learning Objective: Describe the Gaussian copula and explain how to use it to derive the joint probability of default of two assets.

56. A risk committee of the board of company ABC is discussing the difference between pricing deep out-of-the-money call options on ABC stock and pricing deep out-of-the-money call options on the USD/GBP foreign exchange rate using the Black-Scholes-Merton (BSM) model. The committee considers pricing these options based on two distinct probability distributions of underlying asset prices at the option expiration date: A lognormal probability distribution, and an implied risk-neutral probability distribution obtained from the volatility smile for options of the same maturity. If the implied risk-neutral probability distribution is used, instead of the lognormal, which of the following is correct?

A. The price of the option on ABC would relatively be high and the price of the option on USD/GBP would relatively be low.
B. The price of the option on ABC would relatively be low and the price of the option on USD/GBD would relatively be high.
C. The price of the option on ABC would relatively be low and the price of the option on USD/GBD would relatively be low.
D. The price of the option on ABC would relatively be high and the price of the option on USD/GBD would relatively be high.

Correct answer: B

Explanation: The implied distribution of the underlying equity prices derived using the general volatility smile of equity options has a heavier left tail and a less heavy right tail than a lognormal distribution of underlying prices. Therefore, using the implied distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively low compared with using the lognormal distribution.

The implied distribution of underlying foreign currency prices derived using the general volatility smile of foreign currency options has heavier tails than a lognormal distribution of underlying prices. Therefore, using the implied distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively high compared to using the lognormal distribution.

Section: Market Risk Measurement and Management
Reference: John Hull, Options, Futures, and Other Derivatives, 9th Edition (New York: Pearson, 2014). Chapter 20, Volatility Smiles.
Learning Objective: Describe characteristics of foreign exchange rate distributions and their implications on option prices and implied volatility.

57. A CRO is concerned that existing internal risk models of a firm, which are governed mainly by the central limit theorem, are not adequate in addressing potential random extreme losses of the firm. The CRO then recommends the use of extreme value theory (EVT). When applying EVT and examining distributions of losses exceeding a threshold value, which of the following is correct?

A. As the threshold value is increased, the distribution of exceedances converges to a generalized Pareto distribution.
B. If the tail parameter value of the generalized extreme-value (GEV) distribution goes to infinity, then the GEV essentially becomes a normal distribution.
C. To apply EVT, the underlying loss distribution must be either normal or lognormal.
D. The number of exceedances decreases as the threshold value decreases, which causes the reliability of the parameter estimates to increase.

Correct answer: A

Explanation: A key foundation of EVT is that as the threshold value is increased, the distribution of loss exceedances converges to a generalized Pareto distribution. Assuming the threshold is high enough, excess losses can be modeled using the Generalized Pareto distribution.

If the tail parameter value of the generalized extreme-value (GEV) distribution goes to zero, and not infinity, then the GEV essentially becomes a normal distribution.

To apply EVT, the underlying loss distribution can be any of the commonly used distributions: normal, lognormal, t, etc., and will usually be unknown. Choosing the threshold value near the estimated mean of the underlying loss distribution is arbitrary and this method is not typically employed. As the threshold value is decreased, the number of exceedances increases.

Section: Operational and Integrated Risk Management
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 7, Parametric Approaches (II): Extreme Value
Learning Objective: Describe extreme value theory (EVT) and its use in risk management.

58. In the Basel framework, a penalty is given to banks that have more than four exceptions to their 1-day 99% VaR over the course of the last 250 trading days. Which of the following causes of exceptions is most likely to lead to a penalty?

A. A large move in interest rates was combined with a small move in correlations.
B. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.
C. A sudden market crisis in an emerging market, which leads to losses in the equity positions in that country.
D. A sudden devastating earthquake that caused major losses in the bank's key area of operation.

Correct answer: B

Explanation: In the case of a bank that changed positions more frequently during the day, a penalty should be considered, but it is not necessarily given. In the case of bad luck, no penalty is given, as would be the case for a bank affected by unpredictable movements in rates or markets. However, when risk models are not precise enough, a penalty is typically given since model accuracy could have easily been improved.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 6, Backtesting VaR.
Learning Objective: Describe the Basel rules for backtesting.

59. A fund manager owns a portfolio of options on a non-dividend paying stock TUV. The portfolio is made up of 7,500 deep in-the-money call options on TUV and 40,000 deep out-of-the-money call options on TUV. The portfolio also contains 20,000 forward contracts on TUV. Currently, TUV is trading at USD 76. Assuming 252 trading days in a year and the volatility of TUV is 18% per year, which of the following amounts would be closest to the 1-day VaR of the portfolio at the 99% confidence level?

A. USD 25,056
B. USD 55,122
C. USD 386,609
D. USD 875,041

Correct answer: B

Explanation: We need to map the portfolio to a position in the underlying stock TUV. A deep in-the-money call has a delta of approximately 1, a deep out-of-the-money call has a delta of approximately zero and forwards have a delta of 1.

The net portfolio has a delta (D_p) of about 1*7,500 + 0*40,000 + 1*20,000 = 27,500 and is approximately gamma neutral.

Let: α = 2.326 (99% confidence level)
S = price per share of stock TUV = USD 76
D_p = delta of the position = 27,500
σ = volatility of TUV = 0.18

Therefore, the 1-day VaR estimate at 99% confidence level is computed as follows:

$\alpha * S * D_p * \sigma * \text{sqrt}(1/T) = (2.326)*(76)*(27{,}500)*(0.18/\text{sqrt}(252))$ = USD 55,122.41

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 11, VaR Mapping.
Learning Objective: Describe the method of mapping forwards, forward rate agreements, interest rate swaps, and options.

60. A portfolio manager at an investment company is evaluating a two-asset portfolio under management. The risk and return data on the assets and the portfolio are shown in the table below:

Asset	Position Value (EUR million)	Return Standard Deviation (%)	Beta
HIJ	140	20.0	1.6
KLM	160	12.0	0.8
Portfolio	300	13.7	1.2

What is the marginal VaR of asset HIJ; the percent contribution of asset KLM VaR to portfolio VaR; and the portfolio's estimated diversified VaR at the 95% confidence level?

A. Marginal VaR of HIJ = 0.1803; percent contribution of asset KLM VaR = 42.67%; portfolio diversified VaR = USD 0 million

B. Marginal VaR of HIJ = 0.1803; percent contribution of asset KLM VaR = 74.67%; portfolio diversified VaR = USD 3.5 million

C. Marginal VaR of HIJ = 0.3606; percent contribution of asset KLM VaR = 42.67%; portfolio diversified VaR = USD 10.0 million

D. Marginal VaR of HIJ = 0.3606; percent contribution of asset KLM VaR = 74.67%; portfolio diversified VaR = USD 21.5 million

Correct answer: C

Explanation:

$VaR_p = \alpha$*portfolio standard deviation*portfolio value = 1.645*0.137*USD 300,000,000 = USD 67,609,500

Marginal VaR of Asset HIJ = $(VaR_p*\beta_{HIJ})$/(portfolio value) = (USD 67,609,500*1.6)/(USD 300,000,000) = 0.3606

Marginal VaR of Asset KLM = $(VaRp*\beta_{KLM})$/(portfolio value) = (USD 67,609,500*0.8)/(USD 300,000,000) = 0.1803

The VaR contribution of each asset to portfolio VaR is obtained by computing their component VaR. Representing the weight of each asset by W, thus,

Component VaR of Asset HIJ = $VaR_p*\beta_{HIJ}*W_{HIJ}$ = USD 67,609,500*1.6*(140/300) = USD 50,481,760
Component VaR of Asset KLM = $VaR_p*\beta_{KLM}*W_{KLM}$ = USD 67,609,500*0.8*(160/300) = USD 28,846,720

Therefore, the percent contributions to VaR of component are:

HIJ contribution = $CVaR_{HIJ}/VaR_p$ = USD 50,481,760/USD 67,609,500 = 0.7467 = 74.67% = $\beta_{HIJ}*W_{HIJ}$
KLM contribution = $CVaR_{KLM}/VaR_p$ = USD 28,846,720/USD 67,609,500 = 0.4267 = 42.67% = $\beta_{KLM}*W_{KLM}$

Sum of stand-alone asset VaRs = $VaR_{HIJ} + VaR_{KLM}$ = USD 1.645*0.2*140,000,000 + 1.645*0.12*160,000,000 = USD 46,060,000 + USD 31,584,000 = USD 77,644,000

Therefore, the portfolio diversified VaR = USD 77,644,000 – USD 67,609,500 = USD 10,034,500

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 7: Portfolio Risk — Analytical Methods.
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

QUESTIONS 61 AND 62 REFER TO THE FOLLOWING INFORMATION

A financial risk consultant assumes that the joint distribution of returns is multivariate normal and calculates the following risk measures for a two-asset portfolio managed by a mid-sized insurance company:

Asset	Position (CNY)	Individual VaR (CNY)	Marginal VaR	VaR Contribution (CNY)
Financial	15,000,000	3,494,700	0.216	3,240,000
Energy	15,000,000	6,999,300	0.462	6,931,238
Portfolio	30,000,000	9,241,650		9,241,650

61. If the energy asset is dropped from the portfolio, what will be the reduction in portfolio VaR?

A. CNY 2,242,350
B. CNY 3,494,700
C. CNY 5,746,950
D. CNY 6,999,300

Correct answer: C

Explanation: If Energy asset is dropped, the portfolio will contain only financial asset. Then the new portfolio VaR is that of Financial alone (CNY 3,494,700), which implies that dropping Energy asset will result in a reduction in portfolio VaR of CNY 9,241,650 – CNY 3,494,700 = CNY 5,746,950

62. Suppose that the risk consultant defines risk capital of the insurance company by VaR. Assuming a market risk premium of 4.5% and a risk-free interest rate of 2.5%, what is the correct estimate for the return on risk capital on the financial asset?

A. 5.7%
B. 6.3%
C. 7.0%
D. 9.3%

Correct answer: A

Explanation: Marginal $\text{VaR}_F = \beta_F$*(Portfolio VaR)/(Portfolio Value). So,
B_F = Marginal VaR_F*Portfolio Value /Portfolio VaR = β_F = (0.216*30,000,000)/(9,241,650) = 0.7012; and

Expected return on Financial = risk-free rate + (market risk premium)*β_F*= 2.5% +(4.5%)*0.7 = 5.7%

VaR of the Financial = CNY 3,494,700; and the return = 0.057*(CNY 15,000,000) = CNY 855,000

Therefore, the return on risk capital = CNY 855,000/CNY 3,494,700 = 0.24447 = 24.5%

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 7: Portfolio Risk — Analytical Methods.
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

63. An analyst regresses the returns of 300 stocks against the returns of a major market index. The resulting pool of 300 alphas has a residual risk of 15% and an information coefficient of 10%. If the alphas are normally distributed with a mean of 0%, roughly how many stocks have an alpha greater than 3.24% or less than -3.24%?

A. 5
B. 15
C. 30
D. 45

Correct answer: B

Explanation: The standard deviation (std) of the alphas = Residual Risk (volatility) x Information Coefficient (IC) = 0.15 * 0.10 = 0.0150. So, 3.24% is twice the standard deviation of the alphas. The alphas follow normal distribution with mean 0, so about 5% of the alphas are out of the interval [-3.24%, 3.24%]. The total number of stocks is 300, so roughly there are 15 alphas that are out of the range.

Section: Risk Management and Investment Management
Reference: Richard Grinold and Ronald Kahn, Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk, 2nd Edition (New York: McGraw-Hill, 2000). Chapter 14, Portfolio Construction.
Learning Objective: Assess the impact of practical issues in portfolio construction, such as determination of risk aversion, incorporation of specific risk aversion, and proper alpha coverage.

64. A risk analyst at an investment bank is reviewing the way performance analysis of hedge funds and real estate funds have been conducted. Each year, whenever a hedge fund stops trading, the hedge fund is removed from the database of hedge funds. Also, because of the addition of new assets to the real estate fund, the liquidity of that asset category has improved each year and trading has become more frequent. Which of the following best describes the impacts these changes have historically had on hedge fund and real estate fund analyses performed using these databases?

- **A.** The average Sharpe ratio of hedge funds is understated and the average Sharpe ratio of real estate funds has increased.
- **B.** The average Sharpe ratio of hedge funds is overstated and the average Sharpe ratio of real estate funds has decreased.
- **C.** The average volatility of hedge funds is overstated and the average volatility of real estate funds has decreased.
- **D.** The average volatility of hedge funds is understated and the average volatility of real estate funds has increased.

Correct answer: B

Explanation: As poor performers drop out of the database, the average performance increases. The removal of poor performers could actually reduce average volatility and the correlation of returns. The Sharpe ratio tends to get inflated due to survivorship bias. With infrequent trading, estimates of volatilities, correlations, and betas are too low when computed using reported returns. Thus, Sharpe ratios would be higher under the circumstances. When trading becomes more frequent, the Sharpe ratios will be lower in – due to higher volatilities – in comparison with those under infrequent trading condition.

Section: Risk Management and Investment Management
Reference: Zvi Bodie, Alex Kane, and Alan J. Marcus, Investments, 10th Edition (New York: McGraw-Hill, 2014). Chapter 24, Portfolio Performance Evaluation.
Learning Objective: Explain the difficulties in measuring the performance of hedge funds.
Reference: Andrew Ang, Asset Management: A Systematic Approach to Factor Investing (New York: Oxford University Press, 2014), Chapter 13, Illiquid Assets.
Learning Objective: Assess the impact of bases on reported returns for illiquid assets.

65. A money manager wants to invest a small amount of new capital that has recently come into a fund. The fund is benchmarked to an index and, rather than adding a new holding, the manager is considering increasing the holdings of one of the four assets whose performances, during the most recent evaluation period, are described in the following table:

Asset	Portfolio Weight	Actual Return	Volatility of Return	Beta to the Index
BDE	0.35	14%	19%	1.20
JKL	0.30	13%	18%	0.90
MNO	0.25	13%	16%	1.00
STU	0.10	10%	10%	0.80

The portfolio manager wants to select the asset that has the lowest marginal VaR as long as its Jensen's alpha is equal to or greater than the market risk premium. Assuming the risk free rate is 3% and the market return is 8%, which asset should the portfolio manager select?

A. Asset BDE
B. Asset JKL
C. Asset MNO
D. Asset STU

Correct answer: B

Explanation: For marginal VaR, we can derive as:

Marginal VaR of asset *i* = (VaR$_p$/Value$_p$)*Beta$_i$ = W*Beta$_i$ (since W or VaRp/Value$_p$ will be the same for all the assets, implying that the size of beta will actually determine the level of marginal VaRs).

Jensen's alpha measure is calculated as:

Alpha = Actual return – Expected return based on systematic risk
= Actual return – (risk-free rate + (Market return – risk-free rate)*Beta)

Therefore, asset JKL has the lowest Marginal VaR and the highest alpha.

Asset	Portfolio Weight	Actual Return	Beta to the Index	Marginal VaR	Expected Return	Jensen's Alpha
BDE	0.35	14%	1.20	1.2W	9.0%	5.0%
JKL	0.30	13%	0.90	0.9W	7.5%	5.5%
MNO	0.25	13%	1.00	1.0W	8.0%	5.0%
STU	0.10	10%	0.80	0.8W	7.0%	3.0%

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 7 - Portfolio Risk: Analytical Methods.
Learning Objective: Explain the difference between risk management and portfolio management, and describe how to use marginal VaR in portfolio management.

66. A risk analyst at an insurance company has determined that a counterparty to the company has a constant default probability of 6% per year. What is the probability of this counterparty defaulting in the third year?

A. 4.98%
B. 5.30%
C. 5.64%
D. 6.00%

Correct answer: B

Explanation:
The probability of default in year 3 = (1–0.06)(1–0.06)(0.06) = 0.0530 = 5.30%.
Choice A is incorrect. It is the probability of default in year 4 = (1–0.06)(1–0.06) (1–0.06)0.06) = 0.0498 = 4.98%.
Choice C is incorrect. It is the probability of default in year 3 = (1–0.055)(0.055) = 0.0564 = 5.64%.
Choice D is incorrect. It is simply the default probability per year, which equals 6.0%.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 10. Default Probability, Credit Spreads, and Credit Derivatives
Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

67. The board of a pension fund is considering the funding risk of its defined benefit plan. Which of the following statements about the pension fund's funding risk is correct?

A. Decreases in interest rates will reduce funding risk.
B. Funding risk represents the true long-term risk to the plan sponsor.
C. The funding risk has been effectively transferred to the employees.
D. The longer the horizon for expected payouts, the lower the funding risk.

Correct answer: B

Explanation: The time horizon of payouts does not eliminate funding risk. In fact it is the mismatch between assets and liabilities that creates funding risk. In an low interest rate environment the value of equities will rise, however the value of the liabilities are likely to increase more thereby exacerbating funding risk. Funding risk is transferred to employees with a defined contribution plan. Immunizing the portfolio, essentially matching duration of assets and liabilities, will reduce funding risk.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw Hill, 2007). Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Distinguish among the following types of risk: absolute risk, relative risk, policy-mix risk, active management risk, funding risk, and sponsor risk.

68. A portfolio manager is evaluating the risk profile for a portfolio of stocks. Currently, the portfolio is valued at CAD 10.7 million and contains CAD 2.1 million in stock SWZ. The standard deviation of returns of stock SWZ is 17% annually and that of the overall portfolio is 13% annually. The correlation of returns between stock SWZ and the portfolio is 0.4. Assuming the portfolio manager uses a 1-year 99% VaR and that returns are normally distributed, what is the estimated component VaR of stock SWZ?

A. CAD 162,972
B. CAD 234,906
C. CAD 253,992
D. CAD 332,152

Correct answer: D

Explanation: Let α(99%) represent the 99% confidence factor for the VaR estimate, which is 2.326, and ρ represent the correlation of stock SWZ with the portfolio, which is 0.4, and V_{SWZ} represent the value of stock SWZ. Therefore,

$VaR_{SWZ} = V_{SWZ} * \sigma_{SWZ} * \alpha(99\%)$ = CAD 2,100,000 x 0.17 x 2.326 = CAD 830,382

Component $VaR_{SWZ} = \rho * VaR_{SWZ}$ = 0.4 x 830,382 = CAD 332,152.8

Section: Risk Management and Investment Management
Reference: Philippe Jorion, *Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition*. (New York: McGraw-Hill, 2007). Chapter 7: Portfolio Risk: Analytical Methods.
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

69. A newly established risk division of a regional financial institution is setting up a Monte Carlo simulation methodology to estimate the firm's aggregate loss distribution. Which of the following loss frequency and loss severity distribution pairs is the most appropriate to use?

A. Binomial distribution for frequency, and Poisson distribution for severity.
B. Lognormal distribution for frequency, and Weibull distribution for severity.
C. Negative Binomial distribution for frequency, and Pareto distribution for severity.
D. Transformed Beta distribution for frequency, and Normal distribution for severity.

Correct answer: C

Explanation: Poisson and Negative Binomial distributions are appropriate for loss frequency while Pareto, lognormal, Generalized Gamma, Transformed Beta, or Weibull distributions (fat-tailed), are generally used for loss severity,

Section: Operational and Integrated Risk Management
Reference: Philippa X. Girling, *Operational Risk Management: A Complete Guide to a Successful Operational Risk Framework* (Hoboken: John Wiley & Sons, 2013). Chapter 12. Capital Modeling**.**
Learning Objective: Explain how frequency and severity distributions of operational losses are obtained, including commonly used distributions and suitability guidelines for probability distributions.

QUESTIONS 70 AND 71 REFER TO THE FOLLOWING INFORMATION

The CRO of Bank LGX, a non-dividend-paying US-based bank is preparing a report to the board of directors on the bank's capital adequacy and planning. Bank LGX is subject to both the Basel framework and the US banking rules governing global systemically important banks (G-SIBs). The bank claims that it was in compliance with all the capital requirements in January 2016 as all Basel III phase-ins have already occurred. The CRO is conducting the analysis for January 2017 using selected and most recent annual performance data, which are shown in the table below:

Item	Value (USD million) as of January 2017
Common equity Tier 1 (CET1) capital	1,515
Preferred stock (noncumulative)	100
Tier 2 capital	827
Risk-weighted assets	26,395
Total assets	42,828
Total exposure	47,460

The CRO also reports the minimum regulatory capital requirements under the revised capital framework as presented in the table below. The capital ratios also include the capital conservation buffer of 2.5% (phased-in at an annual increments of 0.75%, starting January 2016) and a G-SIB surcharge of 3.0% (phased-in at an annual increments of 0.625%, starting January 2016) of risk-weighted assets to be reached by January 2019:

	January 2016 Minimum Ratio	January 2017 Minimum Ratio	January 2018 Minimum Ratio	January 2019 Minimum Ratio
Capital conservation buffer	0.625%	1.25%	1.875%	2.5%
G-SIB surcharge	0.75%	1.5%	2.25%	3.0%
CET 1 ratio	4.5%	5.25%	6.5%	10.0%
Tier 1 capital ratio	6.0%	6.75%	8.0%	11.5%
Total capital ratio	8.0%	8.75%	11.5%	13.5%
Leverage ratio	4.0%	4.0%	4.0%	4.0%

70. Given the regulatory benchmark and the bank's performance, which of the capital requirements does Bank LGX satisfy as of January 2017?

A. CET1 capital ratio only
B. Leverage ratio only
C. Tier 1 capital ratio and Leverage ratio only
D. Total capital ratio and CET1 capital ratio only

Correct answer: D

Explanation: The bank's CET1 capital ratio = (CET 1 capital)/(risk-weighted assets)= (1,515/26,395) = 5.74%. This ratio meets and exceeds the 5.25% minimum CET1 capital requirement;
The bank's leverage ratio = (Tier 1 capital)/(Exposure) = (1,515 + 100)/(47,460) = 3.40%. This ratio does not meet the 4.0% minimum leverage ratio requirement;
The bank's Tier 1 capital ratio = (Tier 1 capital)/(risk-weighted assets)= (1,515 + 100)/26,395) = 6.12%. This ratio does not meet the 6.75% minimum Tier 1 capital requirement;
The bank's Total capital ratio = (Total capital)/(risk-weighted assets)= (1,515 + 100 + 827)/26,395) = 9.25%. This ratio meets and exceeds the 8.75% minimum Total capital requirement;

71. In viewing the results of this capital analysis report and other considerations for Bank LGX's capital planning, which of the following conclusions is correct?

A. The capital conservation buffer can be met by an increase in Tier 2 capital.
B. If the exposure on derivative asset positions decreases, holding other factors constant, Total capital ratio would decrease.
C. The increase in the credit valuation adjustment (CVA) due to the bank's asset counterparty positions would tend to raise the bank's risk-weighted assets.
D. If the bank raises additional CET 1 capital and invests the same amount in gold, Bank LGX's net stable funding ratio (NSFR) will not change.

Correct answer: C

Explanation: C is correct. Increasing CVA charge increases the amount of risk-weighted assets.
A is incorrect. According to Basel, the conservation buffer can only be met by additional CET 1 capital.
B is incorrect. Derivative exposure (as well other off-balance sheet items) are part of the total exposure. As exposure declines, Total capital ratio increases (assuming no change in Total capital).
D is incorrect. The NSFR = (amount of stable funding)/(required amount of stable funding). CET 1 capital, which goes to the numerator, has a weight of 100%. Gold, which goes to the denominator, has a weight of 85%. Thus, the increase to the numerator and denominator will not be exactly the same, so the NSFR changes.

Section: Operational and Integrated Risk Management

Reference: John Hull, Risk Management and Financial Institutions, 4rd Edition (New York: John Wiley & Sons, 2015). Chapter 16. Basel 2.5, Basel III, and Dodd-Frank.
Learning Objective: Define in the context of Basel III and calculate where appropriate:

- Tier 1 capital and its components
- Tier 2 capital and its components
- Required Tier 1 equity capital, total Tier 1 capital, and total capital.

Describe and calculate ratios intended to improve the management of liquidity risk, including the required leverage ratio, the liquidity coverage ratio, and the net stable funding ratio.

QUESTIONS 72 THROUGH 75 REFER TO THE FOLLOWING INFORMATION

In a surprise monetary policy action on August 10, 2015, the People's Bank of China cut its daily currency reference rate against the USD, resulting in a large devaluation of the CNY versus the USD. Immediately after the announcement, the CRO of CMM Bank (CMM), an international bank with headquarters in Shanghai, began evaluating the impact of this and other events on the bank's position.

CMM had outstanding long-term debt denominated in USD and deposits denominated in CNY. A significant portion of CMM's lending portfolio was also denominated in CNY and consisted largely of loans and lines of credit to Chinese manufacturers who were heavily dependent on imported raw materials. Other loans to non-Chinese firms with exposure to China were denominated in USD. The bank's portfolio investments included CNY-denominated Chinese Treasury securities and other sovereign debt.

A portion of CMM's retail customer base had invested on margin in the Chinese equity markets. Over the next few weeks, local stock markets experienced declines in share prices. Many of CMM's larger retail depositors experienced margin calls and had begun to draw down demand deposits to meet them. Offsetting these outflows, however, were increases in the 3-month, 6-month and 9-month term deposit balances at CMM of several large corporate customers. The result was that CMM's overall net deposit flow had been approximately zero.

As a result of credit developments elsewhere in the world, several of CMM's sovereign debt holdings were downgraded, some from AA to A and some from A to BBB. One of the noticeable outcomes was that the bid-ask spreads on many of the sovereign bonds held and traded by CMM widened. Despite these developments, CMM's sovereign debt portfolio remained exclusively investment grade with a weighted average rating of A+.

72. CMM's CRO was concerned about the bank's liquidity position and decided to review the impact of the devaluation and other capital market events on its net stable funding ratio (NSFR). Ignoring any changes in the market value of CMM's sovereign debt holdings, which of the following is correct?

A. The NSFR will not be impacted by the sovereign credit rating changes because the overall sovereign debt portfolio remains investment grade.
B. The NSFR will be reduced by the sovereign credit rating changes but this effect can be offset by selling A-rated sovereign debt and investing the proceeds in gold.
C. The NSFR will not be impacted by the change in demand deposits because the bank's overall deposit level is unchanged.
D. The NSFR will be reduced by the change in demand deposits but this effect can be offset by issuing common stock.

Correct answer: D

Explanation: The shift in the demand deposit base from retail demand deposits to wholesale demand deposits with terms less than one year would reduce the NSFR. The change in retail deposit behavior would likely cause a shifting of demand deposit classification from "stable" to "less stable" also reducing the NSFR. The downward sovereign credit migration would increase the RSF applied to these bonds and reduce the NSFR. The issuance of common stock, which should be classified as Tier 1 capital, would increase the NSFR.

Learning Objective: Summarize the asset liability management process at a fractional-reserve bank, including the process of liquidity transformation.
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 12 - Liquidity and Leverage.
Section: Operational and Integrated Risk Management

Learning Objective: Define liquidity risk and describe factors that influence liquidity including the bid-ask spread.
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 14 - Estimating Liquidity Risks.
Section: Operational and Integrated Risk Management
Learning Objective: Describe and calculate ratios intended to improve the management of liquidity risk, including the required leverage ratio, the liquidity coverage ratio, and the net stable funding ratio.
Learning Objective: Define in the context of Basel III and calculate where appropriate: Tier 1 capital and its components, Tier 2 capital and its components, required Tier 1 equity capital, total Tier 1 capital, and total capital.
Learning Objective: Describe the motivations for and calculate the capital conservation buffer and the countercyclical buffer introduced in Basel III.
Reference: John Hull, Risk Management and Financial Institutions, 4th Edition (Hoboken, NJ: John Wiley & Sons, 2015). Chapter 16 - Basel II.5, Basel III and Other Post-Crisis Changes
Section: Operational and Integrated Risk Management

73. Before the devaluation, CMM's trading desk had established a short call options position on the CNY-USD exchange rate that was made delta-neutral through a spot USD transaction. The position was no longer delta-neutral after the devaluation came into effect and the desk wanted to take steps to make it delta-neutral again. The bank was concerned about whether this would involve buying or selling USD and what impact this might have on liquidity. The trader who initiated the position suggested that, once it was made delta-neutral, the short call options position would be an effective way to hedge the bank's long CNY exposure against further devaluations and that the bank should consider increasing the size of the position accordingly. In considering this situation, what should the CRO conclude?

A. The bank will have to buy USD to make the position delta neutral, but the delta-neutral short call options position is not an effective way to hedge an underlying long CNY exposure against further devaluations.
B. The bank will have to sell USD to make the position delta neutral, but the delta-neutral short call options position is not an effective way to hedge an underlying long CNY exposure against further devaluations.
C. The bank will have to buy USD to make the position delta neutral, and the delta-neutral short call options position is an effective way to hedge an underlying long CNY exposure against further devaluations.
D. The bank will have to sell USD to make the position delta neutral, and the delta-neutral short call options position is an effective way to hedge an underlying long CNY exposure against further devaluations.

Correct Answer: A

Explanation: If the desk had sold call options on the dollar, it had to be buy dollar spot to be delta-neutral. Because the options were more in the money, their absolute value delta increased, so dollars had to be bought. This eliminates choices B and D. The delta-neutral short-call options position would, at best earn the risk-free rate if it was dynamically hedged. Static hedging would likely result in losses if the CNY devalued further. Regardless, it would not be an effective hedge for an underlying long CNY exposure.

Learning Objective: Describe the method of mapping forwards, forward rate agreements, interest rate swaps, and options.
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 11 – VaR Mapping.
Section: Market Risk Measurement and Management
Learning Objective: Differentiate between sources of liquidity risk, including balance sheet/funding liquidity risk, systematic funding liquidity risk, and explain how each of these risks can arise for financial institutions.
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011).Chapter 12 - Liquidity and Leverage
Section: Operational and Integrated Risk Management

74. CMM had CNY-denominated loans outstanding to TVR, a manufacturing firm that generated its revenue in CNY. To hedge some of its risk, CMM had bought CDS protection on TVR from a bank from the same country as TVR, Bank EP. If the default probability of TVR and the default correlation between TVR and Bank EP suddenly increased, which of the following is correct?

A. The value of the CDS will increase and CMM has a wrong-way risk with Bank EP.
B. The value of the CDS will decrease and CMM has a wrong-way risk with Bank EP.
C. The value of the CDS will increase and CMM has a right-way risk with Bank EP.
D. The value of the CDS will decrease and CMM has a right-way risk with Bank EP.

Correct Answer: B

Explanation: Since the default probability of the reference entity (TVR) was increasing, the CDS spread would widen. And also, with the correlation between TVR and Bank EP (the counterparty) increasing, the present value of the CDS for CMM would fall. So, the exposure of CMM with regard to CDS was declining while the default probability of the counterparty was rising. This is a wrong-way risk.

A is incorrect. The value of CDS should decrease as explained in b above. C is incorrect. The value of CDS would increase but CMM had wrong-way risk with Bank EP as explained in B above. D is incorrect. The value of CDS decreased as explained in B.

Learning Objective: Describe financial correlation risk and the areas in which it appears in finance.
Reference: Gunter Meissner, Correlation Risk Modeling and Management, (New York: John Wiley & Sons, 2014). Chapter 1 - Some Correlation Basics.
Section: Market Risk Measurement and Management

Learning Objective: Identify examples of wrong-way risk and examples of right-way risk.
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 15 - Wrong Way Risk.
Section: Credit Risk Measurement and Management

75. The risk management group noticed that the liquidity-adjusted VaR that was being reported by the sovereign debt trading desk in Hong Kong was lower than that reported by the sovereign debt trading desk in Singapore, even on identical bond holdings. What could explain this difference in liquidity-adjusted VaR?

A. The Hong Kong desk uses the constant spread approach and the Singapore desk uses the exogenous spread approach.
B. The Hong Kong desk uses the exogenous spread approach and the Singapore desk uses the constant spread approach.
C. Both desks use the endogenous price approach but the Hong Kong desk uses a higher value for the price elasticity of demand assumption.
D. Both desks use the endogenous price approach but the Hong Kong desk uses a higher value for the transaction cost assumption.

Correct Answer: A

Explanation: As spreads widened, the exogenous spread approach would reflect this in higher liquidity-adjusted VaR, but the constant-spread approach would not. In the endogenous price approach, a higher value for the price elasticity of demand would result in higher VaR. The endogenous price approach normally ignores transaction costs, but even if it incorporated them, lower transaction costs should result in lower VaR.

Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex: John Wiley & Sons, 2005). Chapter 14 - Estimating Liquidity Risks
Learning Objective: Define liquidity risk and describe factors that influence liquidity including the bid-ask spread.
Learning Objective: Differentiate between exogenous and endogenous liquidity.
Learning Objective: Describe the challenges of estimating liquidity-adjusted VaR (LVaR).
Section: Operational and Integrated Risk Management

76. A CRO at an investment bank has asked the risk department to evaluate the bank's 3-year derivative exposure position with a counterparty. The 1-year CDS on the counterparty is currently trading at a spread of 180 bps. The table below presents trade and forecast data on the CDS spread, the expected exposure, and the recovery rate on the counterparty:

	Year 1	**Year 2**	**Year 3**
Expected exposure (AUD million)	15	15	15
CDS spread (bps)	180	300	420
Recovery rate (%)	85	75	65

Additionally, the CRO has presented the risk team with the following set of assumptions to use in conducting the analysis:

- Counterparty's default probabilities follow a constant hazard rate process
- The investment bank and the counterparty have signed a credit support annex (CSA) to cover this exposure, which requires collateral posting of AUD 13 million over the life of the contract
- The current risk-free rate of interest is 2% and the term structure of interest rates will remain flat over the 3-year horizon
- Collateral and exposure values will remain stable over the life of the contract

Given the information and the assumptions above, what is th correct estimate for the credit valuation adjustment for this position?

A. AUD 0.335 million
B. AUD 0.863 million
C. AUD 1.291 million
D. AUD 2.514 million

Correct answer: A

Explanation: To derive the credit valuation adjustment (CVA), we use the standard formula:

$$CVA = \sum_{t=0}^{n} (1 - RR_t)(EE_t)(PD_t)(DF_t)$$

Where (at any time *t*),

- The discount factor (DF_t) is determined from the risk-free rate of 2%; and
- The hazard rate = Spread/(1 – RR) = (180/10,000)/(1 – 0.85) = 12% (true for years 2 and 3);
- The probability of default (PD_t) is derived from its relationship with the constant hazard rate (λ),

PD(t) = 1 – exp(-λt). For instance, PD(1) = 1 – exp(-0.12*1) = 11.31%
PD(2) = 1 – exp(-0.12*2) = 21.34%
PD(3) = 1 – exp(-0.12*3) = 30.23%

- Collateral amounts of AUD 13 million for year 2 and AUD 13 million for year 3 are considered.

Hence, the rest of the derivation becomes:

(Expected Exposure, Collateral, and CVA in AUD million)

	Year 0	Year 1	Year 2	Year 3
Probability of default (PD)		11.31%	21.34%	30.23%
Discount factor (DF)		0.9804	0.9612	0.9423
Recovery rate (RR)		85%	75%	65%
Expected exposure (EE)		15	15	15
Collateral (C)		13	13	13
EE’ (netted)		2	2	2
(1 – RR)*(EE’)*(PD)*(DF)		0.0333	0.1026	0.1994
CVA = Σ(1 – RR)*(EE’)*(PD)*(DF)	**0.335**			

Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 12, Credit Value Adjustment.
Learning Objective: Calculate CVA and CVA spread with no wrong-way risk, netting, or collateralization. Explain the impact of incorporating collateralization into the CVA calculation.
Section: Credit Risk Measurement and Management

Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Define the hazard rate and use it to define probability functions for default time and conditional default probabilities.
Section: Credit Risk Measurement and Management

77. The CEO of a large bank has reported that the bank's framework for managing operational risk are consistent with Basel II and Basel III model for operational risk governance. Which of the following actions and principles of the bank is correct?

- **A.** The bank considers identification and management of risk as the second line of defense
- **B.** The bank considers independent review and audit of the risk processes and systems as the third line of defense
- **C.** The bank includes damaged reputation due to a failed merger in its measurement of operational risk
- **D.** The bank excludes destruction by fire or other external catastrophes from its measurement of operational risk

Correct answer: B

Explanation: Sound operational risk governance, according to Basel, relies on three lines of defense: (i) First line of defense - business line management, which is responsible for identifying and managing the risks inherent in the products, activities, processes and systems for which it is accountable; (ii) Second line of defence – an independent corporate operational risk management function, generally complementing the business line's operational risk management activities; (iii) Third line of defense – an independent review – review and audit of the bank's operational risk management controls, processes and systems.

Basel II and Basel III define operational risk (inclusive of technological risk) as "the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events." Although a number of financial institutions add reputation risk and strategic risk (e.g., due to a failed merger) as part of a broadened definition of operational risk, they are not within the scope of definition by Basel II/III.

Section: Operational and Integrated Risk Management
Reference: Principles for the Sound Management of Operational Risk, (Basel Committee on Banking Supervision Publication, June 2011).
Learning Objective: Summarize the fundamental principles of operational risk management as suggested by the Basel committee.

78. A risk manager has asked a junior analyst to estimate the implied default probability for a BBB-rated discount corporate bond. Relevant information on other fixed-income securities are given below:

- The Treasury bond (a risk-free bond) yields 4% per year.
- The one-year BB-rated discount bond yields 8% per year.
- The two-year BB-rated discount bond yields 11% per year.

If the recovery rate on a BBB-rated bond is expected to be 0%, and the marginal default probability in year one is 6%, which of the following is the best estimate of the risk-neutral probability that the BBB-rated discount bond defaults within the next two years?

A. 6.31%
B. 7.27%
C. 12.22%
D. 13.97%

Correct answer: C

Explanation: $(1 + 0.04)^2 = PD * 0 + (1 – PD) * (1 + 0.11)^2 \rightarrow PD = 12.22\%$

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 10, Default Probability, Credit Spreads, and Credit Derivatives
Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

79. Pension fund managers have to deal with a range of policy, risk, and return requirements. Which of the following statements about risk management in the pension fund industry is correct?

A. A pension plan's total VaR is equal to the sum of its policy-mix VaR and active management VaR.
B. Pension fund risk analysis does not consider performance relative to a benchmark.
C. In most defined-benefit pension plans, if liabilities exceed assets, the shortfall does not create a risk for the plan sponsor.
D. From the plan sponsor's perspective, nominal pension obligations are similar to a short position in a bond.

Correct answer: D

Explanation: Liabilities at a pension fund are typically composed of accumulated benefit obligations, measured by the present value of all pension benefits owed to employees discounted by an approximate interest rate. When liabilities consist mostly of nominal payments, their value in general will behave like a short position in a long-term bond.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Describe the investment process of large investors such as pension funds.

80. A financial institution has a two-way collateral support annex (CSA) with a counterparty covering a portfolio valued at JPY 400 million. The margining terms of the collateralized portfolio include a threshold of JPY 180 million, a minimum transfer amount of JPY 30 million, and a margin period of risk of 10 days. Which of the following is correct regarding the size of collateral in mitigating the counterparty risk of the portfolio?

A. A lower threshold value is equivalent to a larger portion of exposure protected by collateral.
B. A shorter margin period of risk is equivalent to a smaller portion of exposure protected by collateral.
C. A lower independent amount is equivalent to a larger portion of exposure protected by collateral.
D. The protection from collateral specified in the CSA is uniform throughout the life of the exposure profile.

Correct answer: A

Explanation: A is correct. Threshold is the amount of uncollateralized exposure. A lower threshold value means a larger portion of exposure is protected by collateral (See CR 2017 reference below).

Similarly, C is incorrect because a lower independent amount is equivalent to a higher threshold. That corresponds to a smaller portion of exposure is protected.

B is incorrect because the margin period of risk is the effective time assumed between a collateral call and receiving the appropriate collateral. It has nothing to do with the amount of collateral.

D is incorrect. Collateral has little effect at both the beginning and end of the exposure profile when there is a threshold cap.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 8 - Credit Exposure.
Learning Objective: Explain the impact of collateralization on exposure, and assess the risk associated with the remargining period, threshold, and minimum transfer amount.

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